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The fabrication of the mathematics teacher as neoliberal subject

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DOI (link to publication from Publisher):
[10.5278/vbn.phd.eng.00059](https://doi.org/10.5278/vbn.phd.eng.00059)

Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):
Munoz, A. M. (2018). *The fabrication of the mathematics teacher as neoliberal subject*. Aalborg Universitetsforlag. Ph.d.-serien for Det Ingeniør- og Naturvidenskabelige Fakultet, Aalborg Universitet
<https://doi.org/10.5278/vbn.phd.eng.00059>

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THE FABRICATION OF THE MATHEMATICS TEACHER AS NEOLIBERAL SUBJECT

**BY
ALEX MONTECINO MUÑOZ**

DISSERTATION SUBMITTED 2018



AALBORG UNIVERSITY
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by

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Dissertation submitted

Dissertation submitted: April 30, 2018

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ISSN (online): 2446-1636
ISBN (online): 978-87-7210-199-6

Published by:
Aalborg University Press
Langagervej 2
DK – 9220 Aalborg Ø
Phone: +45 99407140
aauf@forlag.aau.dk
forlag.aau.dk

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Printed in Denmark by Rosendahls, 2018



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SUMMARY

This Ph.D. dissertation aims at problematizing the discourses about the mathematics teacher through an *intensive reading*, which is accomplished through a Foucault-inspired *discourse analysis* and *historizing of the present*. This implies a critical questioning of dominant discourses about the desired teacher, power/knowledge relationships, technologies of government, and taken-for-granted truths. The discourse analysis enables to rethink the fabrication of the mathematics teachers without the teacher. It enables new ways of conceiving, thinking, and understanding the mathematics teacher as entangled with historical and social conditions. Building on Foucauldian and Deleuzian toolboxes, this dissertation troubles how the mathematics teacher becomes a neoliberal subject, and how certain technologies of government are assembled to make particular kinds of teachers—the *desired mathematics teacher*. The mathematics teacher is understood as a discursive formation that is submerged in a constant becoming and evolving. That is, the mathematics teacher, as a subject, is constantly constituted through discourses (Foucault, 1991a) and social practices (Foucault, 1985).

The dissertation is a collection of papers. It is composed of five non-sequential papers, which operate as an assemblage of interrelated contributions. Also, this dissertation deploys two movements. The first is *an unpacking of discourses through an intensive reading*. This movement is an analysis of the discursive network (re)produced by international agencies (paper 1), of the research about the mathematics teacher (paper 2), and of the Chilean official reports and research (paper 3). It seeks to unpack the taken-for-granted truths that circulate in relation to the—desired—mathematics teacher. The second movement is *the conducting of the mathematics teacher conduct*—governmentality. This movement shows how regimes of truths and power/knowledge relationships operate through technologies of government. The conduct of the mathematics teacher's becoming is framed under a *quasi-Darwinist* rationality, in which the teacher must be constantly aspiring to be the *fittest*, (paper 4). As part of the technologies of government, planned obsolescence conducts the mathematics teacher and establishes a rationality that promotes investing more and more in him/herself as the only way of avoiding to become *obsolete* (paper 5).

The discursive network (re)produces and shapes the conditions in which the mathematics teacher is constituted by disposing and normalizing what is considered a good (productive and desired) teacher, as well as what can be enunciated and investigated. Within circulating discourses a narrative about the desired teacher is drawn, in which the good mathematics teacher becomes a myth since this teacher is not a real teacher, neither a reachable teacher. Nobody achieves to be the one desired, even those who are considered “good teachers”. Moreover, within these discourses, the mathematics teacher is framed as being in a constant struggle for his/her survival. In other words, there exists a struggle of not becoming obsolete.

The constitution of more and more (re)training programs is established as the solution for any mathematics teacher's problem. Finally, it is possible to identify within the discursive network the constitution of power/knowledge relations and processes of subjectivation in which the mathematics teacher turns from the "I must"—the mathematics teacher conducted by one other—towards the "I want" and "I need"; that is towards self-management and self-conduct of the mathematics teacher.

DANSK RESUME

Denne Ph.d.-afhandling sigter imod at problematisere diskursen omkring matematiklæreren igennem en *intensiv læsning*, som opnås igennem en Foucault inspireret *diskursanalyse* og *historisering af det nuværende* [historizing of the present]. Dette involverer en kritisk udspørgning af de dominante diskurser omkring den idealiserede lærer, magt-/videnrelationer, styringsteknologier og formodede sandheder. At gentænke matematiklæreren som en fabrikation af det diskursive og det sociale åbner op for nye måder at opfatte, tænke og forstå matematiklæreren. Med brug af Foucault- og Deluzianske værktøjskasser problematiserer denne afhandling, hvordan matematiklæreren bliver et neoliberalt subjekt, og hvordan visse styringsteknologier sættes sammen til at facilitere specifikke typer af lærere—*den idealiserede lærer*. Matematiklæreren forstås som en diskursiv formation, som er i en konstant tilblivelse- og udviklingsproces. Det vil sige, at matematiklæreren som subjekt konstant konstitueres igennem diskurser (Foucault, 1991a) og sociale praksisser (Foucault, 1985).

Denne afhandling udgøres af en samling af fem artikler, som opererer som en samling af indbyrdes forbundne diskurser. Artiklerne er ikke organiseret kronologisk. Desuden indeholder afhandling to bevægelser. Den første indeholder *en problematisering af diskursen igennem en intensiv læsning*. Denne del er karakteriseret ved analysen af det diskursive netværk, som (re)produceres af internationale netværk (artikel 1), igennem forskning vedrørende matematiklæreren (artikel 2) samt gennem officielle Chilenske rapporter og forskning (artikel 3). Afhandlingen søger her at afdække taget-for-givet sandheder, som flourer i relation til—den idealiserede—matematiklærer.

Dernæst analyseres *politisk styringsrationalisering af matematiklæreren* [«The governmentality of the mathematics teacher»]. Denne del viser hvordan sandhedsregimer [regiments of truth] og magt-/vidensrelationer opererer igennem styringsteknologier. Styringen af matematiklærerens tilblivelse [becoming] formes i forhold til en kvasi-Darwinistisk rationalitet, i hvilken læreren konstant må aspirere imod at være *den stærkeste* [fittest], (artikel 4). Som en del af disse styringsteknologier er ”planlagt overflødighed” styrende for matematiklærerens adfærd [conduct] og etablerer en rationalitet, som promoverer en større og større grad af selvinvestering hos læreren—i sig selv—som den eneste udvej for ikke at blive *overflødiggjort* (artikel 5).

Det diskursive netværk (re)producerer og former betingelserne for, hvordan matematiklæreren konstitueres som en god (produktiv og attråværdig) lærer, samt hvad som kan benævnes og undersøges. Indenfor de flourerende diskurser identificeres et narrativ omkring den attråværdige lærer, hvor ‘den gode matematiklærer’ bliver en myte, siden denne hverken er virkelig eller opnåelig.

Ingen kan opnå at blive ‘den attråværdige’, selv de som opfattes som ‘gode lærere’. Desuden former diskurserne, at matematiklæreren er i en konstant overlevelseskamp. Med andre ord foregår der en overlevelseskamp imod overflødiggørelse. Inddragelsen af flere og flere (gen)op læringsprogrammer bliver etableret som en løsning for ethvert identificeret problem eller mangel ved matematiklæreren. Endelig er det muligt, indenfor det diskursive netværk at identificere konstitueringen af magt-/videns relationerne og subjektificeringsprocesserne indenfor hvilke matematiklæreren bevæger sig fra “jeg må”- matematiklæreren som forvaltet af ‘en anden’- imod “jeg vil” og “jeg behøver”; matematiklærerens selvforvaltning.

ACKNOWLEDGEMENTS

I'm not good with words. You will see it as you read my thesis. But I want to thank all of you.

And quoting the beautiful words of a dear fictional character

“Uuuuuuuuuur Ahhhhhrrrrrrrrr Uhhrrr Ahhhhhrrrrrrrrr Aaaaaaargh”

(Chewbacca)

And I meant every word!

TABLE OF CONTENTS

Chapter 1. Introduction	13
1.1. <i>Intensive reading</i> : a way of studying the mathematics teacher	13
1.2. A non–traditional inquiry and its contentions.....	15
1.3. Structuring the thesis	16
1.4. Outline of the chapters.....	20
Chapter 2. Displacing the study about the mathematics teacher	23
2.1. Constituting the problem	23
2.2. Characterizing the studies about the mathematics teacher	30
2.3. So what is the matter?	34
Chapter 3. Operating with the toolbox	37
3.1. The mathematics teacher and Foucauldian and Deleuzian toolbox.....	38
3.2. Mathematics teacher, neoliberalism and the society of control.....	41
3.3. Researching the mathematics teacher from discursive network.....	42
Chapter 4. The unpacking discourses	47
Chapter 5. The conducting of the mathematics teacher’s conduct	112
Chapter 6. Fabricating the mathematics teacher	144
Literature list	148

CHAPTER 1. INTRODUCTION

1.1. INTENSIVE READING: A WAY OF STUDYING THE MATHEMATICS TEACHER

This dissertation is an effort of problematizing power and knowledge relationships that evidence a discursive network in which the mathematics teacher's subjectivity is shaped. The aim of this problematization is to understand the mathematics teacher as part of a social and political machinery, in which the teacher governs him/herself through forms of regulation—what Foucault (2010) calls *technologies of the self*—and at the same time, he/she governs others in order to respond both to social interests and demands—what Foucault (2010) calls *technologies of governing*. This dissertation aims at revealing the fabrication of the mathematics teacher as a political and economic subject within neoliberal rationality. This has been achieved by deploying an *intensive reading* (Deleuze, 1995) of documents about the mathematics teacher (these documents are publications produced by research about the mathematics teacher, by international agencies' reports, and by Chilean official reports and research).

In order to study the mathematics teacher, on the one hand, one may deploy a *traditional inquiry*, in which inferences are drawn, through empirical observation, about who the mathematics teacher is, how the mathematics teacher must be and act, or why the mathematics teacher is as he/she is. The large majority of research developed about the mathematics teacher operates in this form, furthering the dominant discourses and the orthodoxy that has characterized this field of study. The main purpose of *traditional inquiry* is to provide solutions to diverse problems concerned with the teaching and learning of mathematics and mathematics teachers. Also, this type of inquiry seeks for the improvement of all aspects considered deficient. In this vain, Skott, Van Zoest, and Gellert (2013) assert that mathematics education research—mathematics teacher research is no exception—has the function of “understanding and contributing to the practices of mathematics teaching and learning” (p. 505). Within *traditional inquiry*, the mathematics teacher is being characterized and represented under a binary logic, for example, good/bad teacher, successful/unsuccessful teacher or effective/ineffective teacher. The arguments formulated are been drawn in terms of what mathematics teachers have (or they should have) and they do not have. On the other hand, one may deploy an inquiry that breaks with the orthodoxy of *traditional inquiry*. This is precisely the main goal of this dissertation as it focuses on the discursive network concerning the mathematics teacher through an *intensive reading*.

But, what does it mean to deploy an *intensive reading* of documents about the mathematics teacher? Firth of all, according to Deleuze (1995), there are two ways

one could read a book. Firstly, the orthodox, one searches for signified and signifiers, in this vein, reading is a matter of interpretation and hermeneutic. Secondly, the *intensive reading*, one leaves out the interpretation and considers the book as “a little non-signifying machine” (p. 8), which aligns with a Foucauldian approach, given that, as Mills (2001) asserts, “this process of trying to ‘discover’ the ‘real’ meaning of the text is simply an illusory practice” (p. 68). This way of reading the book is, in Deleuze (1995), related with what is Outside and the question turns towards how it works:

[the first way one could read a book] you either see it as a box with something inside and start looking for what it signifies, and then if you're even more perverse or depraved you set off after signifiers. And you treat the next book like a box contained in the first or containing it. And you annotate and interpret and question, and write a book about the book, and so on and on. Or there's the other way: you see the book as a little non-signifying machine, and the only question is 'Does it work, and how does it work?' How does it work for you? If it doesn't work, if nothing comes through, you try another book. This second way of reading's intensive: something comes through or it doesn't. There's nothing to explain, nothing to understand, nothing to interpret. It's like plugging in to an electric circuit [...] This second way of reading's quite different from the first, because it relates a book directly to what's Outside. A book is a little cog in much more complicated external machinery [...] This intensive way of reading, in contact with what's outside the book, as a flow meeting other flows, one machine among others, as a series of experiments for each reader in the midst of events that have nothing to do with books, as tearing the book into pieces, getting it to interact with other things, absolutely anything... is reading with love. That's exactly how you read the book. (pp. 7–9)

Intensive reading has been used as one way of operating in the educational research field. For example, St.Pierre (2004) deploys an *intensive reading* for thinking the subject, education, and science by using Deleuzian concepts. She does this by giving up “the pretense of signifying and ‘making meaning’ in the old way” (p. 283). An *intensive reading* of the empirical materials analysed in this dissertation involves displacing the discussion and the problematization of the mathematics teacher beyond a concrete teacher or group of teachers; to rethink the mathematics teacher and his/her fabrication entangled with political, social and economic dimensions; to map the dominant rationality embodied in the (re)production of knowledge that concern the mathematics teacher; and to unpack power effects in the shaping of the mathematics teacher's subjectivities. In this light, the mathematics teacher is thought and problematized from his/her exteriority and is understood as a flow—in a constant process of becoming—, which enables disrupting the orthodoxy that has characterized the studies about the mathematics teacher and opening its scope,

“break[ing] with the alleged coherence or “order” of mathematics education” (Straehler-Pohl, Pais, & Bohlmann, 2017, p. 4).

The strategy of *intensive reading* seeks to open a discussion on why we think the mathematics teacher the way we do, and how the (desired) mathematics teacher has been discursively fabricated—through the shaping of a particular mathematics teacher’s subjectivity. A Foucauldian approach allows new paths for disrupting current discourses, “think[ing] in new spaces and to consider new possibilities for thought” (S. J. Ball, 2013, p. 5). It allows (re)thinking the mathematics teacher, by looking beyond what is built around his/her practice—often targeted to the classroom—, and by challenging dominant discourses and social structures (Morgan, 2012) to map how power/knowledge relationships conduct mathematics teachers conduct towards what has been desired at a given time and place. The *intensive reading* invites us to connect the (re)production of discourses both internally and externally, promoting a critical gaze of social, cultural, political, and economic forces that are entangled in the fabrication of the mathematics teacher.

The *intensive reading* strategy is accomplished through a Foucault-inspired *discourse analysis* and *history of the present*, drawing from Foucauldian and Deleuzian theoretical tools, such as *dispositive* (Deleuze, 1992b; Foucault, 1972), *regime of truths* (Foucault, 1991a), *discourses* (Deleuze, 1986; Foucault, 1971, 1980), *desire* (Deleuze & Guattari, 1977) and *societies of control* (Deleuze, 1992a). These theoretical tools help in troubling how the mathematics teacher is shaped into a neoliberal subject—mathematics teacher’s subjectivity—and how certain technologies of government are assembled to make particular kinds of mathematics teachers—the fabrication of the desired teacher.

1.2. A NON-TRADITIONAL INQUIRY AND ITS CONTENTIONS

Drawing on Foucauldian and Deleuzian tools, the mathematics teacher is (re)thought within a discursive network, in order to make visible other possibilities of conceiving and understanding the mathematics teacher. As this inquiry searches to break with the orthodoxy that has characterized the research on the mathematics teacher, this would be impossible without a critical reading—*intensive reading*—of what is enunciated and (re)produced about the mathematics teacher. Three contentions, which are of two natures, are drawn. The first and second contentions entail the mathematics teacher and his/her fabrication, and the third contention entails ways of researching the mathematics teacher. *The first contention* is that there is no notion about the mathematics teacher that is permanent and fixed. *The second contention* is that the mathematics teacher must be understood within the frame of capitalism and its practices. And finally, *the third contention* is that the way of researching about the mathematics teacher constitutes an orthodoxical gaze of the teacher.

The mathematics teacher studied and problematized in this inquiry is not a concrete subject or group of subjects that have as profession to teach mathematics, rather it is a discursive formation shaped by power/knowledge relationships, naturalized truths, and governing technologies. In line with a Foucauldian approach, the idea that the subject—in this case the mathematics teacher—and his/her practices are governed by universal or preexisting principles is rejected, instead the subject is constituted within an array of discursive practices. In words of Deleuze (1991), the subject is constituted within the given, through repetition and anticipation. In consequence, this dissertation could be considered as a non-traditional inquiry about the mathematics teacher. Since its focus is not on a concrete mathematics teacher or a group of teachers, rather the discursive network that governs the mathematics teacher's ways of being and acting, and, at the same time, that (re)produces a certain rationality, truths, and power/knowledge relationships.

This dissertation moves towards the problematization of the discursive network intertwined within research and reports—both national and international—about the mathematics teacher. In doing so, the data considered in this study is taken as much more than just a mean for getting information about teachers, their deficiencies, achievements, or challenges. These reports and research shape technologies that govern teachers under specific power/knowledge relationships. Although, that the focus is not on concrete mathematics teachers does not mean that this dissertation has nothing to do with them, given that discursive networks configure the desired mathematics teacher's ways of being and acting within which the becoming of pre- and in-service mathematics teachers is embedded.

1.3. STRUCTURING THE THESIS

The empirical materials

Academically and socially when someone refers to the mathematics teacher, there is an allusion to certain knowledge or statements that have been set by research or by national and international agencies. The research and reports produced by diverse agencies shape a discursive network of knowledge, which promotes who the mathematics teacher is and must be in accordance to what society desires. In alignment with a Foucauldian approach, to study how mathematics teachers become particular subjects through knowledge is central for understanding the ways in which power operates in the modern society.

The empirical material for the analysis of discursive network is constituted by three sources. a) *Reports published by international agencies*, b) *research about the mathematics teacher* and c) *Chilean official reports and research*. These three sources are articulated and entangled “to think both about how the ‘global’ impacts on the ‘national’, while acknowledging, at the same time, the extent to which the national is critical in the formation of global policy agendas” (S. J. Ball, 2016, p.

550). Even though, dominant discourses circulate within diverse sources, such as newspapers and news websites (see Andrade–Molina, 2017a), the analysis deployed here is focused only on the three sources mentioned above.

The first source is composed by *reports published by international agencies*, such as OECD and UNESCO. In specific, it considers those reports focused on mathematics education and the mathematics teacher (e.g. OECD, 2013b, 2014b, 2016b), as well as those reports focused on social welfare and development (e.g. OECD, 2013a, 2015, 2016a). These reports are based on large-scale studies, providing a global insight of mathematics education and the must be of the mathematics teacher, interpreting the international school system outcomes, and suggesting recommendations and proposals for educational improvements (Lindblad, Pettersson, & Popkewitz, 2015). International agencies promote a discourse that operates in an area that

is not simply an area between and betwixt policy, research and practice; it is also a site for constituting educational judgements, recognising types of objects and drawing conclusions about manageable fields of existence that are not just numbers. The activities in this site also signal societal beliefs about how education is conceived and, perhaps more importantly, what it should be like. (Pettersson, Popkewitz, & Lindblad, 2017, p. 30)

The second source is composed by *the research about the mathematics teacher* produced in the last 10 years. Primarily the articles published in the *Journal of Mathematics Teacher Education (JMTE)*, *Zentralblatt für Didaktik der Mathematik (ZDM)*, and *Educational Studies in Mathematics (ESM)*, as well as the book chapters published in the *Third international handbook of mathematics education* and *The international handbook of mathematics teacher education*. Mathematics education research is not an innocent activity; it (re)produces languages and tools, which shape what we see and say within mathematics education (Pais & Valero, 2012); it shapes what is desirable, and, at the same time, it articulates the ways of achieving it (Popkewitz, 2011).

The third source is composed by *the Chilean official reports and research*, such as draft laws (e.g. MINEDUC, 2012, 2016), national reports (e.g. Letelier, 1940; Nuñez, 1883), and by studies about Chilean teachers (e.g. Cox & Gysling, 1990; Gutiérrez, 2008). These documents show how in the Chilean context the teacher, in specific the mathematics teacher, has become an object of intervention and policy. The use of these materials seek to show how the notion of the mathematics teacher changes according to specific spatiotemporal conditions, as well as how the teacher has been continually divided, ordered, reshaped, and hierarchized.

The papers:

As a collection of papers, this dissertation is composed of five papers (see table 1). These papers operate as an assemblage of interrelated discourses, which are no-sequential. In order to unpack the fabrication of kinds of teacher that circulate within a discursive network, the mathematics teacher is rethought as part of a complex network of power. It is possible to see that some ideas and notions resonate throughout the papers, such as the well-trained mathematics teacher, the need of improving the mathematics teacher, or the idea that the mathematics teacher will always be in deficit. These resonances—the ideas and notions—are framed in certain rationalities, nuancing the discursive network and ways of thinking and understanding the mathematics teacher. The following table (table 1: *List of papers*) presents the order in which the papers are going to appear, how they are going to be referred throughout the next chapters, and finally their status.

Papers	Codification	Status
Mathematics teachers as products and agents: to be and not to be. That's the point!	<i>Product</i> <i>Agent</i>	Published
The desired mathematics teacher: mapping and problematizing the discourses in JMTE	<i>Desired mathematics teacher</i>	Submitted
The professional mathematics teacher: fabricating and governing of teacher becoming	<i>Professional</i> <i>Autonomous</i> <i>Continuous training</i> <i>Good decision-maker</i>	Submitted
The mathematics teacher's quasi-Darwinism. Problematizing the mathematics education research	<i>Evolution</i> <i>Fittest</i>	Published
Outcome of the market: the outdated mathematics teacher	<i>Outdated</i> <i>Obsoleted</i>	Published

Table 1. *List of papers*

The movements:

This dissertation is deployed in two movements: *the unpacking discourses through an intensive reading* and *the conducting of the mathematics teacher's conduct*. The entanglement of these movements enables different assemblages to become possible, which favors to what Deleuze and Guattari (1994, p. 59) phrased as “nonthought within thought”. The main aim of these two movements are not to define how the

mathematics teacher should be or how he/she should improve to become the desired mathematics teacher, neither to establish the correct way of training him/her. In alignment with Foucault, the interest is opening a reading about the mathematics teacher to transform him/her and to transform us, through questioning the circulating truths and discourses, as well as to reveal the configuration that makes possible to position the mathematics teacher as a social, cultural, political, and economic matter. In other words, to problematize the ways in which the mathematics teacher is constituted as part of the neoliberal circuit.

I don't construct my analyses in order to say, 'This is the way things are, you are trapped.' I say these things only insofar as I believe it enables us to transform them. Everything I do is done with the conviction that it may be of use. (pp. 294-295)

The first movement, *the unpacking discourses through an intensive reading*, is characterized by the analysis of discursive network (re)produced by international agencies (paper 1), by the research about the mathematics teacher (paper 2) and by the Chilean official reports and research (paper 3). This analysis seeks to unpack the truths that circulate in relation to the mathematics teacher, in order to problematize the fabrication of the desired mathematics teacher. Paper 1 is focused on the power effects of discourses (re)produced by international agencies, the fabrication of the mathematics teacher's subjectivity and the desired mathematics teacher. It argues that the mathematics teacher is framed in a double bind, the mathematics teacher is a *product* of governing, which is responding to constant demands and requirements of society, but at the same time, the teacher is an *agent* for the government of others through the teaching and learning of mathematics (paper 1). Paper 2 maps problematizes the (re)production of the discursive network that shapes mathematics teacher research. It unpacks *the desired mathematics teacher* that the discursive network constitutes, through the study of truths and dominant narratives, by deploying a quali-quantitative strategy that articulates and combines Foucauldian discourse analysis and network analysis. The regimes of knowledge and power shape the current ways of thinking and understanding the mathematics teacher, controlling and disposing the mathematics teacher's ways of being and doing. In concordance with the discursive network weaved by the mathematics teacher research, the desired mathematics teacher must have a repertoire of knowledge and techniques to put in operation for surpassing any problem and challenge of his/her practices. Moreover, he/she must possess personal attributes that favor his/her job, enabling him/her to respond to his/her social context. But, as argued, this teacher will always have deficits that obstaculize his/her effectiveness and competitiveness (paper 2). Paper 3 unpacks how the notion of the mathematics teacher has changed within Chilean society, revealing how the discursive assemblage of social development and school mathematics promote a particular mathematics teacher—in drawing different ways of conceiving and understanding him/her—the *autonomous professional* that has to be in *continuous training* and has to become a *good decision-maker*. The teacher is characterized and fabricated within a narrative of

exaltation and degradation. This narrative recognizes that mathematics teachers play a key role in society and, at the same time, that they do not have enough repertoire of knowledge and techniques for becoming effective and competitive and to be considered successful. Here it is argued that the constitution of the mathematics teacher as a professional frames the teacher within a political and economic agenda (paper 3).

The second movement, *the conducting of the mathematics teacher's conduct*, seeks to show how regimes of truths and power/knowledge relationships are operating, shaping technologies of government in which the mathematics teacher is embedded in a constant becoming and evolving. In other words, the mathematics teacher should acknowledge that his/her own goal is to become the *fittest*. In this light, the fabrication of the mathematics teacher is positioned within a social, cultural, political, and economic machinery. *Quasi-Darwinism* has been proposed as a model that conducts the becoming of the mathematics teacher (paper 4). As part of the technologies of government, planned obsolescence conducts the mathematics teacher conduct into investing more and more in him/herself as the only way of avoiding to become *outdated* and as the secure way to remain “productive” in the system (paper 5). In specific, paper 4 discusses how the survival of the *fittest* as the cornerstone in the fabrication and becoming of the mathematics teacher is established. A quasi-Darwinism entails a narrative in which the *fittest* mathematics teacher is not the one that can better adapt him/herself to change, rather the one that is able to *evolve* for becoming the more competent and effective teacher (paper 4). Paper 5 illustrates the configuration of a mathematics teacher considered to be always *outdated*, by problematizing the circulation of a promise of salvation embodied in the discourses of permanent training and retraining. The fabrication of the mathematics teacher is framed within planned obsolescence; in which the teacher is destined to be *outdated*, to be constantly desiring something new, and to be in a permanent process of becoming and in debt (paper 5).

1.4. OUTLINE OF THE CHAPTERS

This dissertation is structured in five chapters. The first chapter, the *introduction*, articulates the analytical strategy deployed—a different reading of the studies about the mathematics teacher—, promoting to a non-traditional inquiry of the teacher. It argues about why to problematize the mathematics teacher as a fabrication by putting the focus on discourses. The inquiry's contentions are presented, as well as the structure the dissertation. The second chapter, *displacing the study about the mathematics teacher*, has the role of positioning the problem addressed in this dissertation; the starting point is the exaltation and the degradation of the mathematics teacher within the discursive network. It shows that the articulation of arguments about the mathematics teacher is in function of his/her deficits. Also, it characterizes the studies about the mathematics teacher in order to unpack the orthodox gaze from which the mathematics teacher has been looked at. The third

chapter, *operating with the toolbox*, reveals the key concepts of both Foucauldian and Deleuzian frameworks used for, on the one hand, (re)thinking the mathematics teacher and his/her fabrication, on the other hand, shaping an inquiry beyond the mathematics teacher. It provides the theoretical and methodological landscape, by showing the analytical strategy deployed throughout papers. The papers that shape the *first* and *second movement* of the inquiry are deployed to constitute *chapter 4* and *5* respectively. And finally, the sixth chapter, *fabricating the mathematics teacher*, draws and discusses the main arguments and conclusion regarding the fabrication and the becoming of the mathematics teacher as a political and economic subject.

CHAPTER 2. DISPLACING THE STUDY ABOUT THE MATHEMATICS TEACHER

This chapter sets the problematization addressed in this dissertation. The focus of this problematization is to unpack the fabrication of the mathematics teacher constituted within a neoliberal grid, through a study of the discursive network. In doing so, power/knowledge relationships, regimens of truth, and rationalities that make possible the configuration and circulation of a desired mathematics teacher are unveil. In other words, “[w]hat is questioned is the way in which knowledge circulates and functions, in relations to power” (Foucault, 1982, p. 781), rethinking the mathematics teacher and his/her fabrication as ever-changing, always reshaping and responding to particular spatiotemporal conditions. Which is in concordance with Foucault (1994b), when he stated that:

It would be interesting to try to see how a subject came to be constituted that is not definitively given, that is not the thing on the basis of which truth happens to history—rather, a subject that constitutes itself within history and is constantly established and reestablished by history. (p. 3)

Currently, there is a multiplicity of discourses about the mathematics teacher being (re)produced within diverse social spheres. These discourses have enunciated how the mathematics teacher must be and act, and, at the same time, have expressed what constitutes the desired mathematics teacher. Such circulating discourses are constantly reconfigured according to new social demands, needs, interests and dispositions, among other; are constituting constantly a new mathematics teacher, as well as new ways of thinking and understanding him/her. An *intensive reading* of documents about the mathematics teacher opens a study that entangles the fabrication of the mathematics teacher with the ideas of social progress, well-being and economic development, in order to “identify the emergence of new control strategies and the reconfiguration of old ones” (N. Rose, 1999, p. 240). That is, the *intensive reading* strategy seeks to reveal the productive side of power. Apparently, it would seem that this dissertation is moving away from the mathematics teacher, since its focus is set on his/her exteriority—primarily on discourses about the mathematics teacher and how these discourses shape a network that makes possible a particular teacher—, but it is not.

2.1. CONSTITUTING THE PROBLEM

Mathematics as a field of knowledge production has a privileged position in the eyes of governments, business and parents [...] Success in mathematics is highly valued, performing a gate-keeping role, and raising achievement levels is constantly called for by virtually every

element in society [... T]his privileged position can be seen to place mathematics education in greater danger, as the research community feels itself free to pursue “internal” issues of teaching and learning mathematics whilst policy makers put pressure on teachers to perform according to their own pedagogical and curricular demands in the name of all sorts of “external” issues (Lerman, 2014, p. 188)

In navigating by diverse dominant discourses about the mathematics teacher, it is possible to identify certain recurrences and saturations in the enunciations (re)produced within diverse academic and social means. As the quotation above expresses, it is recurrent within research to recognize the privileged position of mathematics or to argue about its key role in the society; given that mathematics, and its teaching and learning, have been considered to be relevant for society by international agencies such as OECD (see OECD, 2016b). Mathematical knowledge becomes a cornerstone of modernity providing a language for science and technology, and a valid—and desired—way of thinking and arguing, as Smid (2014) asserts “in modern society, mathematics education is now seen as indispensable for every citizen” (Op. cit., p. 590). Mathematics education is constituted by an ethics that “establishes mathematical knowledge as good, by making such knowledge have beneficial consequences” (Lundin, 2012, p. 81). In this context, the mathematics teacher has “the Promethean task of bringing light [mathematical knowledge] to children for the benefit and progress of humanity” (Montecino & Valero, 2015, p. 794). However,

[e]ffective mathematics teaching depends to a large extent on the expertise of teachers; consequently their knowledge of the subject – of mathematical principles and processes – and their professional training are crucial. Good teaching is reliant not only on teachers’ mathematical subject knowledge and skills, but also on their understanding of how to teach their subject and of how students learn – both of which are essential if teachers are to reflect on and respond to the needs of their students (European Commission, 2011, p. 113).

Nowadays, it would seem that it does not matter where or who enunciates something about the mathematics teacher since everyone use very similar arguments or formulations for referring to teachers’ practices, repertoires of knowledge and techniques, responsibilities, roles and results, amongst others. Plenty statements about the mathematics teacher are articulated in function of the mathematics teacher’s *deficits*, namely, what he/she has, needs or must improve, develop or acquire in order to achieve desired outcomes or to enhance the teaching and learning of mathematics. Chapman (2017) asserts that in studies about elementary school mathematics teachers, some researchers are focused on deficiency-oriented studies highlighting what mathematics teachers lack in terms of knowledge and what should be fixed through teacher (re)training programmes. Nevertheless, “[t]his deficit-based way of understanding and educating mathematics teachers is potentially more

damaging than helpful to the teachers” (Op. cit. , p. 203), since this focus tends to dehumanize the teacher, promoting simplistic views of knowledge, the teaching/learning process and their interrelationship. Popkewitz (1992, p. 303) contends that “[t]he social organization of reading the factual accounts “inserts” categorical and syntactic procedures into the actuality of education; thus establishing a normalcy to schooling based on pathological distinctions”. And thus, the mathematics teacher’s deficits operate to make *pathological* teachers, in regard to what the teacher does not have and what is desired for his/her to have, embodying a double gesture (Popkewitz, 2017), which inscribes the pathological of the mathematics teacher as part of the normal. Although, it has been acknowledged that these deficits should be eradicated. The pathological mathematics teacher is a teacher that needs to be administered and changed (fixed or improved), and to be studied and examined through scientific procedures. In this fashion, all teachers become pathological, since there exists no teacher that does not need to constantly improve.

In the Chilean context, according to the discourses (re)produced in different social and academic levels, it is highlighted that the Chilean mathematics teacher does not manage or does not have the repertoire of (mathematical and/or pedagogical) knowledge and techniques required for a successful practice and for students to acquire certain tools and knowledge that are socially required and desired. Despite the different natures of the three sources used for illustrating the circulation of the idea aforementioned (the first source is a report that was presented for the Ministry of Education of Chile (MINEDUC), the second is a news published in Cooperativa’s website, and the third is a report formulated in the late nineteenth century) and despite that one of these sources was elaborated more than 100 years ago, the recurrence of discourses evidence that: *the mathematics teacher must improve*. For example,

A significant percentage of teachers in their practices do not show a deep understanding of mathematical knowledge, which is appreciated in a restricted and fragmented representation of mathematical contents. (Rodríguez et al., 2013, p. 89, my translation)

The prospective teachers dominate a 40% of curricular contents required at an international level for mathematics and only a 30% of pedagogical aspects. (Cooperativa, 2010, my translation)

The mathematics teacher lacks teaching methods (Nuñez, 1883, p. 213, my translation)

It is possible to find similarities within the statements (re)produced by the mathematics teacher research and international agencies, when they refer to mathematics teachers and their quality, knowledge, tools, personal attributes, and so on.

Low sense of efficacy and the teachers' perceived lack of preparation were two factors that impacted how the teachers taught and interacted with their students [...] teachers who have low efficacy are less open to trying new ideas and implementing innovative teaching strategies (Francis, 2015, p. 196).

Pre-service teachers tend to have difficulties in perceiving or interpreting students' work. These skills seemed to be influenced by their level of mathematical knowledge. [...] Teachers' showed deficits in terms of proposing instructional strategies to foster students' understanding that go beyond "showing how to do it right" (Stahnke, Schueler, & Roesken-Winter, 2016, p. 23).

One of the deficiencies that an educator may possess is an inability to make decisions (Freire, 2008, p. 210).

Teachers may have become accustomed to teaching a certain way throughout their careers without taking a step back and reflecting on whether the teaching methods they are using are really the best for student learning. It's time for all of us to stop and think (OECD, 2016c, p. 19).

Following their initial education, mathematics teachers must continue to update their knowledge and skills (European Commission, 2011, p. 122).

To show how the mathematics teacher constantly fails apparently has become the main target for a great part of research and (inter)national reports, prompting to a constant degradation of the mathematics teacher. The research in mathematics education "is often predicated on identifying deficiencies in current practices as part of a rationale for implementing a new approach" (Brown, Hanley, Darby, & Calder, 2007, p. 184), and, also, is often focused on "improving school achievement in standardized terms rather than merely studying it and understanding it[...], making promises of how research outcomes will provide specific understandings of education and so improve it" (Brown, Solomon, & Williams, 2016, p. 288). For example, Skott et al. (2013) declare that

the teacher is often seen as a major obstacle to change and a major problem of implementation. Consequently, the task for teacher-related research and development work is to solve the problem by changing teachers' beliefs and providing them with opportunities to develop forms of knowledge that are deemed relevant for the profession. (pp. 502-503).

Moreover, in an editorial note in the *Journal of Mathematics Teacher Education*, Chapman (2016a) asserts that four papers composing issue 1 of volume 19

offer promising approaches to impact specific changes to varying degrees for teachers. They provide evidence of the nature of change that is possible[...] and offer mathematics teacher educators guidance in supporting practising and prospective teachers' learning and change[...] Given that there is ongoing need for significant changes in the teaching and learning of mathematics, ongoing work to understand the relationship between approaches to teachers' learning and change is important in order to continue to improve both (p. 5).

Currently teachers are constantly *deprofessionalized* and *reprofessionalized*, they must learn that they can become more than what they are and that they can be better than other teachers. In other words, they must recognize the potential they have, within themselves, of becoming outstanding and successful mathematics teachers (S. J. Ball, 2003).

Thus, according to the circulating discourses, it has been acknowledged that, on the one hand, the mathematics teacher “must be specially prepared and this preparation must include a variety of components – mathematical, pedagogical, and methodological” (Smid, 2014, p. 591), on the other hand, the mathematics teacher does not reach the levels or standards desired and required by society, and in all likelihood he/she won't reach these in the future. Even if some mathematics teachers are considered to be “good” teachers, nothing can assure that they will become competent and effective. Likewise, if a teacher is considered “good” this does not mean that he/she will be exempted of from being outdated—*obsolete*. Furthermore, the projections of policymakers and educational authorities influence what has been perceived a good teacher is, “and often contradict, the teachers' professional identities” (Gellert, Espinoza, & Barbé, 2013, p. 543). It would seem that all teachers are destined to fail or to become obsolete, since the desired mathematics teacher is unreachable even for those considered to be good teachers. A similar effect to what Andrade–Molina (2017b) contended regarding the fabrication of the desired child through school mathematics,

Here, the desired child comes into an unreachable illusion inside a system where everything is already taken to be a failure. All students are already failing, even if they are “good students” [...] This happens within a regime of truth in which all possible approximations of becoming what is desired are unfruitful. The desired child remains in the realm of the virtual, of immanence: A platonic desired citizen. Students will never be good enough to become the desired child, not because they are unable to learn mathematics but [...] they are disabled by the impossibility to reach a Platonic desire (p. 76).

The teacher is a pathological subject that is always in *debt*, at risk of failing and with a constant need of improvement. Rose (2009) recognizes that ‘qualified teachers’ are praised in public documents and speeches, [but] teachers are often pegged as the

problem” (p. 57). The mathematics teacher has been established as an important theme and object of study within research and (inter)national organizations. More concretely, “in the last 30 years, many efforts have been made to explore the connection between mathematics teachers’ professional knowledge and their instructional practices, with respect to their students’ achievement” (Stahnke et al., 2016, p. 2). Even OECD (2016b) asserts that the quality of the teacher is key to improving students outcomes. However,

[w]hereas there is a long history of discussion and debate around the connection between teacher knowledge and quality instruction, there is a lack of empirical research testing this hypothesis or even connecting knowledge to student learning (Guerriero, 2014, p. 4)

The search for a better mathematics teacher is promoted through (inter)national policies as part of the solution for the challenges that the modern society faces. The mathematics teacher should be able to transform reality with his/her (good) practices and favor the development of productive citizens. The attempts of reforming education do not simply change what teachers do, but also what they are (S. J. Ball, 2003). In this fashion, the mathematics teacher is framed under the ideas of human and economic capital. And so, his/her achievements are considered as a key indicators for measuring how much he/she lacks—his/her deficits—, as well as what the educational system and society lacks—their deficits. The (re)production of discourses about the constant need for better mathematics teachers has favored the naturalization and circulation of taken-for-granted truths, as well as the constitution of certain forms of subjectivity and of knowledge. The mathematics teacher’s conduct is conducted through the delineating and disposing of the desired ways of being and acting.

Moreover, expert knowledge has been thought to lay the foundations (support and justification) for a successful academic and scientific training.

To be trained academically and scientifically is to have access to scientific knowledge and the latest research results to be used in and related to one’s daily activities as a teacher in the classroom; it is to consume research in an active sense; to be able to understand the scientifically produced knowledge one engages; and to think with such knowledge in one’s work (Sitomaniemi-San, 2015, p. 70).

The content knowledge for teaching, proposed by Ball, Thames and Phelps (2008), , is an example of how research shapes frameworks and specific understandings regarding the mathematics teacher. According to a Foucauldian approach, the production of knowledge is configured as a key element in governing the modern society—in this case the mathematics teacher. Little research about the mathematics teacher has focused on connecting the mathematics teacher with his/her exteriority, in this vain, “there is a lack of research foregrounding power-relations in

mathematics teacher education practices” (Skog, 2014, p. 29). This phenomenon could be explained by Pais (2017b), he acknowledged that mathematics education research is narcissistic, closed in itself, denying those matters that do not fit into its own image. When mathematics education research

confronted with obstacles to the teaching and learning of mathematics that cannot be controlled by research—poverty, inequality, economic constraints, and governmental decisions, but also students’ refusal to assume the symbolic mandate conferred upon them—researchers tend to forsake them for the sake of research. Instead of conceiving these “external” circumstances as the very arena in which the true nature of research’s inner potentials is to be “tested”, researchers conceive them as empirical impediments, thus keeping the presuppositions of research intact (Op. cit., pp. 56-57).

As for research connecting the mathematics teacher with his/her exteriority, it has been recognized that the mathematics teacher is embedded in a context and has a social role or some kind of impact on social development and welfare. Teachers’ context is addressed at least implicitly by the research (Krainer, 2007), being reduced only to enunciating something about the mathematics teacher’s context, but without problematizing it (see paper 2). And “[w]hat is recognized as an economical and political problem [within mathematics education research] ends up being addressed in a technical fashion: better ways to teach and learn mathematics for all students” (Pais, 2012, p. 77).

So, what is the problem addressed in this dissertation? This dissertation is focused on how the mathematics teacher is and has been fabricated in contemporary societies. Through an *intensive reading* of the discursive network shaped by research and (inter)national agencies on the mathematics teacher, this dissertation seeks to go beyond a traditional study, in connecting the fabrication of the mathematics teacher with the outside—exteriority. Thus, to question why do we think and understand the mathematics teacher the way we currently do? And how come we have normalized the mathematics teacher’s ways of being and acting, promoting truths about the mathematics teacher, as well as the teaching and learning of mathematics? By using Foucauldian and Deleuzian toolboxes, this dissertation problematizes the regimes of truth and power/knowledge relationships in which the mathematics teacher is constituted in order to understand the mathematics teacher more in depth (see Chapman, 2016b).

There exists few studies that analyze the mathematics teacher from a political standing. These studies have been focused on educational practices of concrete teachers (e.g. Brown & McNamara, 2011; Walshaw, 2012). Meanwhile, this dissertation aims at opening the discussion towards the problematization of dominant discourses and to break with the orthodoxy that has characterized the field. In doing so, the discussion moves away from the “highlighting of the mathematics

teachers' deficits"; it escapes from proposing a new reading about the should be, the how to improve, and the what to change. Rather, the discussion is displayed into the new possibilities of conceiving and understanding the mathematics teacher. This is possible only when the orthodox way of thinking about the mathematics teacher is challenged. Building on Chapman (2017), in recognizing that the studies about the mathematics teacher need to transcend the approaches that focus on the deficit, the analysis of the discursive network enables to problematize how the (re)production of knowledge about the mathematics teacher—through the exaltation and the degradation of the mathematics teacher—contributes to the fabrication of the desired mathematics teacher: a mathematics teacher that responds to a particular spatiotemporal configuration and that is *self-regulated*, *in debt*, *competitive*, *effective*, a good *decision-maker*, and an *entrepreneur* of him/herself.

This inquiry is not a reconstruction of a series of repetitions and assumptions circulating within the discursive network about the mathematics teacher, rather it unpacks the discursive network—the naturalized truths and the power effects. Moreover, this dissertation is not intended to enunciate something in favor or against the fabrication of the mathematics teacher, nor to judge the ones promoting or (re)producing some discourses and taken-for-granted truths about the mathematics teacher, but to consider the (re)production of discourses on the mathematics teacher as a dangerous practice. In alignment of what Foucault (1983) asserted,

[the] point is not that everything is bad, but that everything is dangerous, which is not exactly the same as bad. If everything is dangerous, then we always have something to do. (pp. 231–232)

Therefore, the focus is on how the mathematics teacher is conducted and how power operates through discursive practices in the fabrication of the mathematics teacher's—neoliberal—subjectivity.

2.2. CHARACTERIZING THE STUDIES ABOUT THE MATHEMATICS TEACHER

Sfard (2005) pinpoints an *era of the teacher*, in which the mathematics teacher has become “the almost uncontested focus of researchers' attention” (Op.cit., p. 409). From the late 1970s, “teachers and teaching have become pivotal concerns of mathematics education research” (Skott et al., 2013, p. 503). The growing number of research on mathematics teachers shows the current interest in making sense of teachers' knowledge, practices, repertoire of techniques, and so on, at the same time it shows the shaping of frameworks and gazes about the mathematics teacher. The tendency within mathematics education is to focus on internal issues of the teaching and learning of mathematics (Lerman, 2014), where “there is a sense that we have to prescribe or at least identify good practice” (Jablonka, Wagner, & Walshaw, 2013, p. 47). In this vein, it seems that the main aim of the research is to develop and to

(re)produce successful experiences (Gutierrez, 2013) to promote solutions (Pais, 2012).

The relevance of the studies about the mathematics teacher could be understood according to the importance mathematics has had for science, technology, and economy. Mathematics is posited as a valuable resource for promoting society's social and economic progress (Pais, 2017a), as well as in the fabrication of citizens (Tröhler, 2015). Currently, "mathematics can be understood as an instrument of power which is trusted by the majority of people and whose rationale is no longer questioned" (Kollosche, 2014, p. 1066). In this light, the teaching and learning of mathematics plays "an important role in the (re)production of contemporary techniques of power" (Op cit, p. 1071). For example, OECD (2014a) acknowledges that mathematics, reading and science are fundamental for the development of society.

Nurturing excellence in mathematics, reading or science, or in all three domains, is crucial for a country's development as these students will be in the vanguard of a competitive, knowledge-based global economy (Op. cit. , p. 9)

Within research, there is a common interest in teachers and their practices (Skott et al., 2013). There are different lines of research composing the mathematics teacher research; lines that cover "a broad range of topics [...such as] mathematics teachers' knowledge, beliefs, identity, learning, teaching and professional development" (Chapman, 2016b, p. 397), as well as mathematics teachers' skills, such as perception, interpretation, and decision-making (see Stahnke et al., 2016). However, "there is a somewhat surprising disconnect between them, leading to an incoherent view of the teacher and her or his role in instruction" (Skott et al., 2013, p. 501). Also, studies about the mathematics teachers seem to be reduced to technical and operational matters for the mathematics teacher's improvement, which has had diverse nuances and meanings in the development of the mathematics teacher research.

The definitions of 'improvement' vary in different contexts and times, and may concern one or several aspects related to, for example, efficiency, effectiveness, social inclusion, or well-being. Regardless of such variation, educational reform rhetoric most often suggests that teachers — as for example, inquirers, problem-solvers, critical and reflective thinkers, or lifelong learners — will bring about change if they are trained, equipped and instructed in the right ways (Sitomaniemi-San, 2015, p. 9).

It might seem that research is caught up in a way of thought and reasoning about the mathematics teacher, in which there is a pre-supposition that everybody knows who the desired mathematics teacher is and that this desired teacher is a universal "on-

size-fits-all” subject (only requiring a few alterations according to each context). Currently, it circulates a common image/idea of what it means to be a (good) mathematics teacher, an image that is possible to see in the recurrences of the discursive network, shaping how the mathematics teacher is conceived and understood (see papers 1, 2 and 3). As aforementioned, most of current studies about the mathematics teacher draw an orthodox gaze of the teacher, in which the ways of thinking, understanding, and conceiving teachers are disposed and deployed, positioning the mathematics teacher as an object of study, as well as the idea that research is the means to produce the valid knowledge for the mathematics teacher to improve.

The orthodoxy that has characterized this field of study has, first, *avored a large part of the research about the mathematics teacher to be formulated on concrete mathematics teachers*, and to be focused on concrete classroom practices in order to improve mathematics teachers’ weakest areas. Gellert, Hernández, and Chapman (2013) assert that research findings should be applied into teachers’ professional development, to modify their practices. Second, it *established and characterized what is considered as a successful and effective practice*. Within circulating discourses, what is taken to be the “good”—successful and effective—mathematics teachers’ practices are being constantly rephrased, and teachers should be able to reach the ever-evolving standards and achievements desired by society. For example, (OECD, 2012) asserts that effective practices of teachers reduce the gaps between advantaged and disadvantaged students. Then, the mathematics teacher is expected to engage in a constant consumption of permanent training, from his/her own self-interest, for his/her practices not become *obsolete* and for aspiring to be considered “good”—with the best practices. Permanent training turns into a salvation narrative to avoid obsolescence, in which the mathematics teacher is blessed with the opportunity of being “deemed *competent*” embedded in a permanent becoming: “those who teach would continue Becoming-Teacher with each new encounter with the Other, each new disruptive learning event” (Marble, 2012, p. 29). Third, it *sought to measure and to study all aspects of the mathematics teacher, through a objective* (or at least that is what it is believed and proposed) *and empirical observations, promoting an expert knowledge*. Research seeks to shape “knowledge that can change the conditions of society that also changes people” (Popkewitz, 2011, p. 177). Most of the research on mathematics teachers can be framed by the cause and effect logic, meaning that this type of research, first, recognizes a problem and, then, proposes a solution. The measuring and studying of the mathematics teacher aims at “[u]nderstanding what mathematics teachers need to know, and what it takes to be able to apply that knowledge in the classroom, [which] is critical for helping teachers improve their practice and their students’ learning” (Kersting et al., 2016, p. 97). And fourth, it *shaped research agendas, adopting ways of (re)producing research and knowledge*. Theoretical and methodological approaches are providing platforms in which the mathematics teacher is characterized, by defining and legitimating argumentations, discussions and

methods, to “constraint and afford what one sees and how one interprets what one sees” (Lerman, 2013, p. 629).

The special issues of the Journal of Mathematics Teacher Education on social justice (JMTE, 2009a, 2009b) and equity (JMTE, 2012) show that, in the last years, there is an increasing interest in studying the mathematics teacher from a sociopolitical approach. This increment is framed in what Gutierrez (2013) has called the *sociopolitical* turn of mathematics education. The research focus has shifted “from examining school structures and institutions to examining discourses and social interactions” (Gutierrez, 2013, p. 39), positioning at the center of mathematics education, theoretically and methodologically, other kinds of concerns and interests (Valero, 2009). For example,

understanding the effects of power, educators can move from a focus on individual psychological factors to larger societal factors that affect social relations, including the extent to which they can transcend the constraints that impinge on their ability to prepare students for socially-conscious (critical) citizenship (Grant & Agosto, 2008, p. 193)

Within research about the mathematics teacher, social problems (i.e. social welfare and social justice) become individual problems—in terms of the mathematics teacher’s competitiveness and effectiveness. Research also prompts to *dividing practices* Foucault (1982), by classifying the teacher, according to a binary logic, as ineffective/effective, bad/good, or unsuccessful/successful. The mathematics teacher is constituted and governed on contradictory bases of uniformity and individuality; it is expected that all teachers become the desired teacher, and, at the same time, he/she must be able of differentiating him/herself from other teachers, by thinking about him/herself and following his/her personal interests.

Some research seems to do something different, or at least partially different, for example: Skog (2014) studies “mathematics teacher education from a socio-political theoretical perspective by focusing on how discursive power-relations affect becoming mathematics teachers’ positioning in different educational contexts” (p. 29). She asserts that her study “contributes to understanding how power-relations may affect discourses within mathematics teacher education” (Op. cit., p. 38). Likewise, Lerman (2014) seeks to identify the effects of policy on mathematics teacher education and his/her identity, through the mapping of the relations between official and unofficial agents and interpreting the effects on mathematics teacher educators. Moscovici (2003) examines how teachers use their own inquiry to change their practice, to understand their power position within the classroom, and the effect of these on classroom practice: “[a]s a result of their own personal analyses, many of the teachers in the study changed their practices to encourage their students to participate in scientific inquiries and become skeptics” (Op. cit., p. 47). The research on the mathematics teacher is still regarded as a means to change and improve teacher’s practices; it is not use as a means for producing ruptures within theories,

methodologies, rationalities and approaches. Neither it is used for (re)thinking what seems natural and normal in order to open other possibilities of understanding and problematizing—“[t]o make the naturalness of the present as strange and contingent is a political strategy of change” (Popkewitz, 2008, p. xv).

2.3. SO WHAT IS THE MATTER?

By building on Foucauldian and Deleuzian approach this dissertation proposes to break with the orthodox gaze that has characterized the studies on the mathematics teacher. Considering, in words of S. J. Ball (2015), how discourses “are formed and made possible” (p. 311) and how they operate in the fabrication of the mathematics teacher’s subjectivities. The research about the mathematics teacher needs to undergo a critical reading, in order to displace the current target of research towards the exteriority of the mathematics teacher. In doing so, it is possible to challenge why we do what we do—(re)producing certain kind of research, discourses and truths, or conceiving the mathematics teacher the way we do—, and how we come to know what we know about the mathematics teacher. Therefore, the strategy is to trouble the common sense within which the mathematics teacher is, and has been, fabricated and researched. The critical analysis of the discursive network about the mathematics teacher, enables to unpack regimes of truth from which the mathematics teacher is conceptualized, differentiated, shaped, and conducted. By deploying an *intensive reading*, this dissertation seeks to go beyond a pre-given image of the mathematics teacher, from a sociopolitical approach, to problematize the fabrication of the teacher and the power effects. The sociopolitical is understood as the historical and cultural production of “rules and standards that police the boundaries of what is possible and not possible to think and to do—what is given as natural and common-sense that governs conduct and that simultaneously excludes and abjects” (Popkewitz, Diaz, & Kirchgasler, 2017, p. 3).

Studies about the mathematics teacher are not established just as a means for describing and explaining issues about the mathematics teacher, rather these are, also, producing a reality in which the desired mathematics teacher is fabricated through the establishment of knowledge based in scientific facts, the (re)production of certain regimens of truths and the constitution of a complex network of power. The outcome of these studies have been—dangerously—used by policy-makers to make sense of a broader understanding of the whole educational system, and, therefore, to pose solutions. For example, “[e]vidence-based policy depends on research results that are not designed to understand the whole system, but rather to statistically identify the functioning of isolated parts of the system (effects)” (Tröhler & Lenz, 2015, p. 757). Research in the field of mathematics education about the mathematics teacher becomes a technology of government in the sense that they are not solely in regard of transferring and producing more knowledge about the mathematics teacher, but they are a way of conducting the teacher’s ways

of being and acting, and of (re)producing systems of reason, truths, and dominant narratives about who the desired mathematics teacher is.

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CHAPTER 3. OPERATING WITH THE toolbox

The toolbox used in this dissertation is entangled to shape the analytical strategy. The toolbox is not to be taken only as a framework (namely ideas, thoughts, or ways of understanding) that are operationalized within a particular methodology. Rather, the toolbox is part of the ways of analyzing and articulating the research, for example, *discourse* is a concept that can be characterized from different approaches, but, at the same time, this involves methodological considerations, framing ways of thinking and understanding. This analytical strategy is drawn for, first, exploring the discursive network and its entanglements with the fabrication of modern mathematics teacher subjectivity; second, thinking the mathematics teacher as a political and economic issue, and as an outcome of power/knowledge relationships; and third, problematizing the rationalities, knowledge and truths about the mathematics teacher in order to unpack the ways of governing his/her subjectivities.

This dissertation does not suppose that there is a “good” or “correct” way of being or becoming a mathematics teacher, there is not “a universal form of subject to be found everywhere” (Foucault, 1988, p. 50). There is not a pre-existing teacher. Prospective teachers do not become teachers because they had to surpass a border that differentiates non-teachers from teachers, but the (expert) mathematics teacher is constituted discursively and is encountered with the other (Marble, 2012). The mathematics teacher is a discursive formations that change according to spatiotemporal conditions. Therefore, this dissertation aims at unpacking how the mathematics teacher is fabricated discursively according to what is desired and demanded by society, and how particular subjectivities are shaped to put in operation certain rationalities, truths and knowledge.

As stated in the previous section, the studies about the mathematics teacher are not particularly reflective and critique, rather, these are an effort of describing and characterizing the desired mathematics teacher by showing how far away the mathematics teacher is from what is desired. Research has been articulating particular discourses about the mathematics teacher and shaping systems of reason that regulate what is possible to do, act, and think (Popkewitz, 2004). The (re)production of a discursive network constitute technologies of government to fabricate certain kinds of teachers.

3.1. THE MATHEMATICS TEACHER AND FOUCAULDIAN AND DELEUZIAN TOOLBOX

Foucault's and Deleuze's oeuvre can be addressed as an adaptable set of tools. This way of understanding their work has been inspired by what Foucault (2001) has enunciated about his writings,

I would like my books to be a kind of *tool-box* in which others can search a tool with which they can do what they want in their field [...] I don't write for an audience, I write for users, not readers (pp. 523-524, my translation).

In the same vein, Deleuze (1995) acknowledges that from the students who attended his courses “nobody took in everything, but everyone took what they needed or wanted, what they could use” (p. 139). According to these adaptable set of tools, it is possible to rethink the mathematics teacher through a Foucauldian and Deleuzian inspired framework to problematize the fabrication of the mathematics teacher in modern society. Regarding the relationship between theory and practice, as Deleuze asserted (Foucault & Deleuze, 1977), practice should not be considered as the application of theory, but rather as an interactive and open-ended process. Reasoning with Foucault and Deleuze, it is possible to understand research, and national and international official reports on mathematics teachers as a discursive practice that has power effects on mathematics teachers' subjectivities, through the (re)production of certain kinds of knowledge and taken-for-granted truths and by providing certain ways of thinking about the mathematics teacher.

In a Foucaultian sense, power is produce by knowledge. As he asserted that

Power produces knowledge; that power and knowledge directly imply one another; that there is no power relation without the correlative constitution of a field of knowledge, nor any knowledge that does not presuppose and constitute at the same time power relations (p, 27).

In this light, circulating discourses about the mathematics teacher are taken as part of a regimen of power/knowledge, in which a particular notion of the mathematics teacher is been (re)produced. Thus, there is a reciprocal connection “of power on knowledge and of knowledge on power” (Foucault, 1989, p. 51). According to Foucault (1972) in modern western societies, the production of knowledge is regulated and limited by certain disciplines—the history of science, biology or economy, for example—, which promote regimes of truth, rationalities, and valid forms of arguing and researching. In other words, knowledge defines the discursive space in which the mathematics teacher is fabricated and constituted. Knowledge is more an issue of the social, historical, and political conditions. Power “needs to be considered as a productive network which runs through the whole social body, much more than as a negative instance whose function is repression” (Foucault, 1980, p.

119), “power produces; it produces reality [...] The individual and the knowledge that may be gained of him belong to this production” (Foucault, 1991a, p. 194). As Walshaw (2016) explains,

Foucault connects his notion of power-knowledge in a circular relation with ‘truth’. He links truth with systems of power that produce and sustain it and to effects of power which it induces and which extends it. (Walshaw, 2016, p. 50)

Discourse must not be understood as a group of signs neither as an excerpt of some text or speech. Discourses are not “a mere intersection of things and words” (Foucault, 1972, p. 45). Rather, discourses must be understood as “practices that systematically form the objects of which they speak” (Op.cit., p. 49); these constitute particular subjectivities and establish a relationship between language, knowledge, and power: “discourse is related directly to power, to regimes of truth, and to grids of specification—the dividing, contrasting, classifying, and relating together of objects of discourse” (S. J. Ball, 2013, pp. 23-24). Additionally, Walshaw (2016) states that the concept *discourse* was used by Foucault “to refer to different ways of structuring areas of knowledge and social practice” (p. 46). Thus, power operates within discourses (Foucault, 1971).. As Mills (2001) expresses, discourses are “something which produces something else[...], rather than something which exists in and of itself and which can be analysed in isolation” (p. 17)

[I]n any society, there are manifold relations of power which permeate, characterise and constitute the social body, and these relations of power cannot themselves be established, consolidated nor implemented without the production, accumulation, circulation and functioning of a discourse (Foucault, 1980, p. 93)

Turning the gaze towards discourse enables decentering the mathematics teacher from the focus. The analysis of the discursive network seeks revealing how power operates in the fabrication of the mathematics teacher. In other words, how technologies of government and *dispositives*¹ (Foucault, 1980) operate to conduct the mathematics teacher’s ways of being and acting. The mathematics teacher is not only subjected by the technologies of the self, but is also subjected by the technologies of the government of others, as shown in paper 1. The fabrication of the desired mathematics teacher embodies the hopes and fears of society. To focus on the fabrication of the mathematics teacher is to acknowledge, on the one hand, the productive side of research through the (re)production of knowledge, of truths,

¹ Dispositives comprise a “heterogeneous ensemble of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions” (Foucault, 1980, p. 194). In words of Deleuze (1992a) a dispositive is a *multilinear ensemble* of techniques, forces, discourses and dispositions, which has a strategic function.

of what is desired, and of rationalities. On the other hand, the materiality of knowledge—research—, which embody principles to order reflection and action (Popkewitz, 2013, Popkewitz et al., 2017). The fabrication has, according to Popkewitz et al. (2017), a dual quality. Firstly, *fictions*, which “direct us how to think about kinds of people in relation to changing historical circumstances” (p. 6). Secondly, *manufacturing*, there are “narratives, stories, and theories that *manufacture*[...] who people are and what they do” (p. 6). In words Sitomaniemi-San (2015), the fabrication of teacher

refers to the making of the teacher through discursive, cultural practices; to the ways in which the teacher is discursively woven into the social fabric; and to the fictive element of such a fabrication [...] Fabrication, therefore, is used here to denote both production (as in the making of a product in a factory), on the one hand, and fabulation (as in the composition of a fairy-tale), on the other hand. (p. 15)

What societies desire is shaping conditions of possibility, in which the mathematics teacher is fabricated. Desire “is understood as a primary active force rather than as a reactive response to unfulfilled need” (Patton, 2000, p. 70), which produces reality² (Deleuze & Guattari, 1977). To consider desire as a productive force does not imply to overlap the understanding of power as a productive network (Foucault, 1980), rather, it positions power in an explicit relation to desire (Bignall, 2008). Even more, if it is supposed that all social relation are, at the same time, “power relations as well as desire-relations, then one and the same social institution may be considered either as an apparatus [dispositive] of power or as a complex circuit of desire” (p. 69). Furthermore, that society desires a specific mathematics teacher does not only mean that society solely desires a particular kind of subject, but also that all mathematics teachers could achieve the desired teacher state. For example, in regard of the rationality and knowledge that teachers will promote in the society, the kind of students that they will be able to fabricate.

The becoming of the mathematics teacher should not be thought as a finished process, rather as the possibilities for diverse ways of being and acting—which are not fixed. That is, the mathematics teacher should be understood “as ongoing event continually expanding beyond the known” (Skeet, 2014, p. 254).

² “[I]f desire is productive, it can be productive only in the real world and can produce only reality” (Deleuze & Guattari, 1977, p. 26)

3.2. MATHEMATICS TEACHER, NEOLIBERALISM AND THE SOCIETY OF CONTROL

In order to position the fabrication of the mathematics teacher within a neoliberal grid, firstly, it is necessary to know what neoliberalism is. Building on a Foucauldian approach, neoliberalism can be understood as a form of governance. Neoliberalism puts in operation principles and strategies for the rationalization of the exercise of government. Neoliberalism refers to the set of ideas and practices that makes the world to be seen in economic terms. Thus, all aspects of society are rethought economically “as calculative actions undertaken through the universal human faculty of choice” (N. Rose, 1999, p. 141). That is, “[t]he application of the economic grid to social phenomena” (Foucault, 2010, p. 239). According to Cotoi (2011), for Foucault “the emergence of ‘economy’ means the appearance of new forms of knowledge and power that are best understood as transformations of the former disciplinary regimes” (p. 113). In this context, schools become markets (Valencia, 2010): what is considered as valuable knowledge is constituted according to the demands of the market (Darder, 2005). Individuals must be constantly assessed, in order to control them through competition and accountability (Sirotnik, 2004).

Indeed, to be a good teacher under neoliberalism, one does not have to gain teaching experience, collaborate with colleagues, conduct inquiry into their own practice, or learn from past literature—one only has to go shopping! A good teacher must be a consumer of certain products [... they] cannot rely on themselves and their professional knowledge (Pitzer, 2014, pp. 37-38)

Sirotnik (2004) asserts that neoliberalism through business-like practices redefines teachers and their work, by motivating teachers with rewards and punishments. Moreover, the teacher “is to become a consumer, and his or her activity is to be understood in terms of the activation of rights of the consumer in the marketplace” (N. Rose, 1999, pp. 164-165). Within neoliberal rationality, the work of the mathematics teacher becomes a set of (good) choices in order to achieve an improvement of the development of his/her human capital. In other words, the teacher becomes an *agent* of his/her own human capital and development, by becoming a good decision-maker (paper 3). The human capital is drawn on “the human-entrepreneur or the individual as entrepreneur of herself” (Cotoi, 2011, p. 115), that is, human capital requires a mobile and flexible self (Foucault, 2010). Lemke (2002) asserts that neoliberalism can be construed “not just as ideological rhetoric, as a political-economic reality or as a practical anti-humanism, but above all as a political project that endeavors to create a social reality” (p. 60), putting in operation new technologies of the self, in which the subject is governed by becoming self-regulated, an entrepreneur of him/herself, allowing him/her a permanent reconfiguration of him/herself in order to be competitive and effective,

being responsible for his/her professional development and success, as well as for his/her productiveness and competitiveness.

The teacher becomes the responsibility of his/her professional development, and permanent training. Permanent training is constituted as a means for controlling and governing the becoming of the teacher. Currently, it constitutes continuous control mechanisms despite the expressions of freedom and flexibility (Deleuze, 1992a) that circulate in different social spheres. The fabrication of the mathematics teacher takes place within what Deleuze (1992a) calls the *societies of control*. The enunciation of the *societies of control* made by Deleuze (1992a) started: ““Control” is the name Burroughs proposes as a term for the new monster, one that Foucault recognizes as our immediate future” (Deleuze, 2010, p. 4). Thus, society of control should be understood not as an overlap, but rather as a displacement of Foucault’s *disciplinary societies*. The societies of control is constituted as the output of the disciplinary society and its model of the confinement. The societies of control is open; it constitutes a new kind of model of power: the control, which generates a new logic and rationality. Control “is short-term and of rapid rates of turnover, but also continuous and without limit, while discipline was of long duration, infinite and discontinuous” (Deleuze, 1992a, p. 6). Also the focus is not on a particular individual, but on the mass, all social and personal aspects become samples or data. In the society of control “[o]ne is always in continuous training, lifelong learning, perpetual assessment, continual incitement to buy, to improve oneself, constant monitoring of health and never-ending risk management” (N. Rose, 1999, p. 234). In other words, the subject is in a continuous process of becoming. In this vein, “technologies of control do not operate by moralization and discipline, nor do they operate through socialization and solidarity. They operate through instrumentalizing a different kind of freedom” (N. Rose, 1999, p. 237); mainly, the freedom to choose and consume.

3.3. RESEARCHING THE MATHEMATICS TEACHER FROM DISCURSIVE NETWORK

In general, the analytical strategy is to locate discourses about the desired mathematics teacher—the circulating discourses that (re)produce and constitute the mathematics teacher research, reports of international agencies, and Chilean official documents and research. An *intensive reading* is deployed in order to problematize the discourses located about the—desired—mathematics teacher, by unpacking truths, rationalities, and power effects, as well as connecting the (re)production of discourses with the exteriority of the mathematics teacher. By mapping the discursive network, it is possible to encounter saturations—recurrent ideas, sentences, truths, and notions that are enunciated again and again by different social agents (as shown in section 2.1).

The *intensive reading* deployed is drawn from two analytical strategies, in specific *discourse analysis* and *history of the present*. With which is opened a discussion regarding the conditions that make possible the enunciation of statements about the mathematics teacher. This involve a critical gaze towards the games of truth in which the mathematics teacher is fabricated through certain systems of knowledge and power, and the ways of conceiving, researching, and thinking the mathematics teacher. The mathematics teacher is problematized through the deconstruction of the discursive network. Thus, the focus is on the discourses and their circulation, recurrences, and connections. And so, it is possible to problematize: what is the notion of the mathematics teacher that circulates? How are statements about the mathematics teacher configured?

What an author can enunciate is embedded in what it has previously been thought, a discursive landscape and rationality. “That is not to suggest that all of the individuals existing within a certain era agree on a particular view of the world, but simply that all of the sanctioned utterances and texts are produced within similar discursive constraints” (Mills, 2001, p. 75). According to Foucauldian position, the author is not the origin of the discourse (Deleuze, 1986), what the author can say or cannot say is tied to a system of reason that circumscribes and determines the discourses (Foucault, 1977). Therefore, an *intensive reading* involves a critical read of the research and reports about the mathematics teacher as a non-personal activity. Ideas and concepts are not the creation of a single individual; the author only exists as a consequence of writing. Foucault (1977) proposed that the author is dead; he and she can no longer be seen nor understood as the only source of meaning in a text (Foucault, 1971)

Regarding discursive networks, the focus is not on the grammatical rules nor in their interpretations, rather power/knowledge relationships that make possible a particular way of writing, of speaking, and of thinking about the mathematics teacher. Discourse must be recognized “as a ‘corpus of statements’ whose organization is relatively regular and systematic” (Arribas-Ayllon & Walkerdine, 2008, p. 100). Foucault (1972) proposes to studying discourses as a search to describe their dispersion and regularities.

[w]hat one must characterize and individualize is the coexistence of these dispersed and heterogeneous statements; the system that governs their division, the degree to which they depend upon one another, the way in which they interlock or exclude one another, the transformation that they undergo, and the play of their location, arrangement, and replacement (p. 34)

The analytical strategy is drawn by, on the one hand, a Foucault-inspired *discourse analysis* (see paper 1, 2, 4, and 5) to problematize the fabrication of the mathematics teacher, the reshaping of the desired teacher, and the circulating truths about the mathematics teacher. Through a *discourse analysis* strategy, it is possible to focus

on power/knowledge effects and forms of subjectivity. According to Arribas-Ayllon and Walkerdine (2008), a Foucauldian-inspired discourse analysis entails a historical inquiry, problematizes the mechanisms of power and their functioning, and has as focus the practices in which subjects are fabricated. In other words, this analysis is directed to *subjectification* (Foucault, 1983).. The term *subjectification* refers to the making of subjects through technologies of power and self. In this vein, it seeks to reveal the ways in which discourses operate in the fabrication of the mathematics teacher. Cheek (2008) asserts that

Foucauldian discourse analysis offers the potential to challenge ways of thinking about aspects of reality that have come to be viewed as being natural or normal and therefore tend to be taken for granted. It can enable us to explore how things have come to be the way they are, how it is that they remain that way, and how else they might have been or could be (Op. Cit., p. 356).

Here, discourse analysis is complemented with the tools of *network analysis* (the mapping of networks and centrality measures, in paper 2). Using these two analytic strategies is to describe systems of dispersion of statements and their regularities, looking to

grasp the statement in the exact specificity of its occurrence; determine its conditions of existence, fix at least its limits, establish its correlations with other statements that may be connected with it, and show what other forms of statement it excludes (Foucault, 1972, p. 28).

Through the convergence and co-occurrences of networks, which were mapped and composed by the recurrence of discourses that compose the mathematics teacher research, the circulating truths about the desired mathematics teacher are unpacked—as well as the rationality that shapes the ways of arguing and enunciating in the research and reports about the mathematics teacher. Thus, the focus is not to unveil if discourse is a true and accurate representation of the reality or of the mathematics teacher, but on how certain discourses become the dominant discourse about a desired subject: the desired mathematics teacher.

On the other hand, the analytical strategy is drawn by a Foucault-inspired *historizing of the present* (see paper 3), regarding the configuration of the mathematics teacher throughout historical changes in Chile. Here, history is used “as a means of critical engagement with the present” (Garland, 2014, p. 367). The *history of the present* is not about the past, but how “the past is intricately woven in constituting the present” (Pereyra & Franklin, 2014, p. 10). It is “seeing the present through different historical trajectories that make possible the objects of thought and actions” (Pereyra & Franklin, 2014, p. 10), by asking “what is happening around us, what is our present?” (Foucault, 1989, p. 407). The corpus of statements, as Arribas-Ayllon and Walkerdine (2008) asserted, not only considers

a variety of discourse samples that will generate answers to a question about our relation to the present, but also incorporate samples that are historically variable. This temporal variability is an important way of showing how[...the mathematics teachers] has been spoken about differently in the past and exposed to different forms of [governing]. (, p. 100)

In other words, it problematizes the discursive practice and power/knowledge relationships wherein the mathematics teacher becomes thinkable and governable.

CHAPTER 4. THE UNPACKING DISCOURSES

The problem does not consist in drawing the line between that in a discourse which falls under the category of scientificity or truth, and that which comes under some other category, but in seeing historically how effects of truth are produced within discourses which in themselves are neither true nor false.
(Foucault, 1980, p. 118)

This movement has focused in unpacking the truths and their power effects that shape the mathematics teacher, how he/she must be and act, and how he/she is conceived and thought. It problematizes the notion of the mathematics teacher that circulates within the discursive network. This is done by putting the focus on the (re)production of a discursive network within international reports (paper 1), mathematics teacher research (paper 2), and Chilean documents (paper 3). Thus, the problem is not drawing a characterization of discourses in order to say what is true or false about the mathematics teacher, rather revealing how discourses are working in fabricating a particular mathematics teacher. It is possible to map the shaping of the desired teacher's ways of being and acting, according to the saturation of the discursive network.

But, how is the mathematics teacher characterized in the dominant discourses? According to the circulating discourses, *the desired mathematics teacher* becomes a subject that must manage and that have different kinds of knowledge, as well as mastering a repertoire of techniques; he/she must possess personal attributes in accordance with his/her responsibilities and labors. However, he/she also has deficits that should overcome in order to respond, in the best possible way, to the diverse challenges of his/her context (paper 2). The mathematics teacher is considered an autonomous *professional* that has to engage in *continuous training* and has to be a *good decision-maker* (paper 3); becoming a *product* of technologies of governing and an *agent* for governing others through mathematical knowledge (Paper 1).

However, as proposed throughout paper 1, 2, and 3, the mathematics teacher is governed through *debt*. As aforementioned, he/she will never be enough. The mathematics teacher will always need something more, something to improve, to change, and to update. This enables to think that the mathematics teacher will always be changing and becoming—in *debt*—, by promoting the idea that teachers must *evolve* in order to be the competent and effective teachers that society desires. And that the only way of evolving is through permanent training. It seems that the

mathematics teacher with more (and better) repertoires of knowledge and techniques become successful and useful for the modern society.

Mathematics teachers are understood as *autonomous* individuals with tools and knowledge to choose what kind of a teacher they want to become: a teacher that fits social demands and desires, a useful teacher for society, and a teacher with an independent and scientific judgment. Self-regulation become a key characteristic of the mathematic teacher. Through self-regulation the mathematics teacher is governed without being governed (Foucault, 2010).

Montecino, A., & Valero, P. (2017). Mathematics Teachers as Products and Agents: To Be and Not to Be. That's the Point! In H. Straehler-Pohl, N. Bohlmann, & A. Pais (Eds.), *The Disorder of Mathematics Education: Challenging the Sociopolitical Dimensions of Research* (pp. 135-152). Cham: Springer International Publishing.

Chapter 9

Mathematics Teachers as Products and Agents: To Be and Not to Be. That's the Point!

Alex Montecino and Paola Valero

Abstract Studying mathematics teachers in the Political invites to understand how teachers' subjectivities emerge in the entanglement of the individual in discursive-material formations. We focus on the power effects of the expert discourses by international agencies such as OECD and UNESCO in the fabrication of the mathematics teacher's subjectivity. Deploying a Foucault-inspired discourse analysis on a series of documents produced by these agencies, we argue that nowadays cultural thesis about who the mathematics teacher should be are framed in a double bind of the teacher as a policy product and as a sales agent. Narratives about the mathematics teacher are made possible within a dispositive of control, which makes mathematics education and mathematics teachers the cornerstone for realizing current market-oriented, competitive, and globalized societies.

Introduction

In a conversation with a prestigious colleague, the topic of what it meant to adopt a political perspective to study mathematics teacher education came to the fore. Discussing the differences and similarities of mathematics teachers' work in different countries, the impact of international agencies such as OECD and its Program for International Student Assessment (PISA) became clearly a topic. In the colleague's view, PISA had not had a significant impact on the work of teachers because the ideas behind PISA had never made it to the classrooms. Teachers have difficulties in designing tasks that would realize the ideals of PISA in their everyday work with students. This kind of statement is an example of a truth that has emerged in the field of teaching and learning, as well as in mathematics education research:

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© Springer International Publishing Switzerland 2017

H. Straehler-Pohl et al. (eds.), *The Disorder of Mathematics Education*,
DOI 10.1007/978-3-319-34006-7_9

135

International comparative assessments contribute positively to increase people's mathematical competence. At the same time, mathematics educators ought to align in the realization of such good intentions, since better mathematical achievement of the kind that the assessments measure will lead to the improvement of living conditions at individual and national levels within a global economy. Mathematics teachers, in particular, ought to be committed to selling PISA's effective models.

We want to problematize such truth and consequently we use the statement of our colleague and its inherent rationality as a starting point in our analysis. We are not interested in asserting whether our colleague is right or wrong but in the way some ideas are accepted and become naturalized truths. Problematizing them implies, for example, recognizing the regime that the whole dispositive of PISA articulates. Such a task is beyond the scope of this chapter, and some other authors have started such endeavour (e.g. Kanes, Morgan, & Tsatsaroni, 2014). We focus on the discursive framing for the making of the mathematics teacher nowadays, and at this particular moment, we cannot ignore the force that the expert visions of international organizations display in such making. Thus, we intend to advance a research agenda of political studies on the mathematics teacher by displacing the analysis of teachers out of their minds, knowledge and beliefs, and out of classrooms, schools and teacher education. Accordingly, we pay attention to the *cultural theses* (Popkewitz, 2008) forming around who the mathematics teacher should be in the expert discourses of international agencies and research.

Gates and Jorgensen (2009) argue that while there is a myriad of political studies in mathematics education concerned with "social justice," little research has been done concerning the political dimensions with regard to teachers and their education. Two issues of the *International Journal of Mathematics Teacher Education* were dedicated to filling this gap in the literature. A political perspective on teachers and teacher education would ask "how teacher education plays a part in the furtherance of a practice which evidently works against the interests of many learners. Significantly, such socially unjust practices are not imposed upon teachers; they are enacted by them, and believed by them to be essential and natural" (Gates & Jorgensen, 2009, p. 164). The papers in the two issues include studies of practices in initial and in-service teacher education where an effort is made to challenge the implication of teachers themselves in the creation of inequalities. The political dimensions in this collection then seems to be connected to how teacher education can/cannot promote awareness for inclusive teaching and learning that would lead to more social justice.

Following Pais and Valero (2012) we would go a step further and argue that understanding teachers and their work in the Political requires a study of how teachers' subjectivities emerge in the inseparable entanglement of the individual and the discursive-material formations within which people and practices of teaching mathematics unfold. Brown and McNamara (2005) already conducted a study of primary mathematics teachers in England trying to understand the emergence of what counts as mathematical practices of teaching and teachers "shaped between the individual's grasp of the subject and the institutional definition of it" (Brown & McNamara, 2005, p. 2). They examined how curriculum and government policy impact on the teacher students' becoming teachers. Our approach diverges from Brown's and

McNamara's in that we direct our gaze away from concrete teachers and towards the expert discourses that nowadays seek to govern and to conduct teachers' professional life. Therefore, the attempt to delve into the current ways of reasoning and the encompassing cultural theses about who the mathematics teacher should be is an important effort to study mathematics teachers politically.

The "mathematics teacher" that we discuss here is not a concrete individual of flesh and bone. It is a discursive construction, where power is actualized in articulating ways of thinking about desired forms of being, and where the meaning of and expectations for the mathematics teacher is configured and negotiated. However, saying that the "mathematics teacher is not a concrete person" does not mean that we are simply talking about thin air formulations that have nothing to do with real people. On the contrary, these ways of reasoning frame possibilities of being and becoming. In particular, we examine the expert discourses about the teacher produced by international agencies such as OECD and UNESCO claiming to know how to fix the problems of education, particularly through the making of teachers as objects of policy. We also connect these to the expert discourses of research in mathematics teacher education existing in the literature.

With our analysis, we are seeking to show that the discursive frame for subjectivity of the mathematics teacher is configured in the tension between the mathematics teacher as a *policy product* and as a *sales agent*. The teacher is an object of policy (OECD, 2005) and, therefore, s/he is caught in a double bind: s/he is a product of governing technologies operating through policy, that respond to demands and requirements of society. At the same time, s/he is an agent for governing that has to sell effectively a highly valued knowledge—the mathematical knowledge—by conducting people's mathematical learning and achievement, for the betterment of the individual students and society. Furthermore, this double bind is made possible as an effect of power within the market-driven logic being performed through a dispositive of control, such as the expert knowledge systems, which international agencies and their comparative studies are part of. In other words, the double bind that frames mathematics teachers' subjectivity nowadays is closely connected to the expansion of particular capitalist understandings of education and teachers, where mathematics and mathematical competence, firstly, make particular sorts of people, and secondly, are key values to govern, control, and give value to people.

The chapter begins by positioning the mathematics teacher in contemporaneity and delineating the analytical strategy utilized in doing so. We present the network of discourses that configure and frame the mathematics teacher, which are putting in operation diverse lines of force for delimiting who the teacher is and must be. In the second section we trace and map circulating statements about teachers. We navigate, firstly, in the discourses fabricated by OECD and UNESCO about the teacher and the mathematics teacher as an object of policy, and secondly, in the discourses and ideas that circulate about students' mathematics achievement and how teachers produced it. We show how in these two types of discourses the mathematics teacher is framed as a social product and as a sales agent respectively. In the third section we open up the analysis of the documents by discussing the double bind of the making of the teacher in relation to the notion of societies of control. Finally, we discuss the contributions of this problematization to the political studies of mathematics teachers.

Researching Mathematics Teacher's Subjectivity in Discourse

In this study we operate with some concept tools for unpacking the discursive network framing mathematics teachers' subjectivity. These tools draw on Foucault's studies on discourse and subjectivity, and Popkewitz's cultural theses.

Enunciations are part of collective practices and the systematic and regular use to promote the conditions to configure statements that compose *discourses*. "We shall call discourse a group of statements in so far as they belong to the same discursive formation" (Foucault, 1972, p. 117) and, as Arribas-Ayllon and Walkerdine (2008) put it, discourses describe rules, divisions, and systems of a particular body of knowledge from specific spatiotemporal conditions. Furthermore, discourses "establish what kind of person one is entitled/obliged to 'be'" (MacLure, 2003, p. 176). Hence, discourse analysis is an analytical strategy that makes possible to trace the enunciations and statements that shape particular ideas about the mathematics teacher's subjectivity and his/her ways of thinking and being.

To trace statements is not a straightforward path to follow; some traces are lost and some seem unconnected. More than a clear line of argument, enunciations and statements are entangled in a discursive network where *cultural theses* about the mathematics teacher become visible. Popkewitz (2008, p. 5) argues that "to talk of cultural theses is to focus on how different sets of ideas, institutions and authority relations are connected to order the principles of conduct."

OECD and UNESCO are two institutions that in the last decades have gained prominence in enunciating what education around the world should be. Their documents encapsulate expert discourses that articulate ways of understanding and thinking about education, teachers and mathematics teachers. Popkewitz (2015, p. 1-2.) argues that the reports of international agencies:

[p]rovide entrance to a style of thinking and acting that moves among different institutions and social actors, such as policy discourses and discussions among teachers' unions and public debates [...] The grey-zone area in which the reports operate, then, is more than mediating schemas between research and policy. They provide insight into the numbers as constituted in the international assessments as cultural practices about how to make judgments, to recognize types of objects, and draw conclusions in making manageable fields of existence that are never merely that of numbers.

Within the OECD and UNESCO documents, we can find that a large number of reports have focused on teachers. For example, OECD (2005, p. 220) asserts that teachers "[are] important not only for improving the knowledge base for teacher policy, but also as a way of introducing new information and ideas to schools." UNESCO (2015, p. 1) recognizes that "teachers are a critical education resource in every country." Therefore, these documents become an important source for examining the discursive framing of mathematics teacher's subjectivity in contemporaneity, seeking, firstly, to understand how the discourses in these documents generate systems of reason and cultural theses, which fabricate the desired mathematics teacher. For this study, the material analysed are the documents produced by OECD and UNESCO, such as: the documents by OECD *Teachers Matter: Attracting, Developing and Retaining Effective Teachers* (2005); *Mathematics Teaching and*

Learning Strategies in PISA (2010); *PISA 2012 Mathematics Framework* (2010); and *Equity, Excellence and Inclusiveness in Education: Policy Lessons From Around the World* (2014). The documents by UNESCO *The challenge of teacher shortage and quality: Have we succeeded in getting enough quality teachers into classrooms* (2015); *Evolution of policies on teacher deployment to disadvantaged areas* (2015); and *Challenges in basic mathematics education* (2012).

We deploy a Foucault-inspired discourse analysis (Arribas-Ayllon & Walkerdine, 2008, Jørgensen & Phillips, 2002). With this analysis, we seek to problematize truths that circulate in discourses and understand how these are established and configured. A discourse analysis helps to direct attention to questions of subjectivity, context and the socio-historical dimensions of discourse (Angermüller, 2014). From these ideas, the discourse analysis seeks to throw light on how in circulating discourses the current image of the mathematics teacher has been shaped. In other words, the discourse analysis that we deployed provides a way of thinking about how diverse cultural theses emerge in what is enunciated, conducting the mathematics teacher to particular ways of reasoning, thinking and being.

Tracing and Mapping Statements on the Teacher

To begin with, we need to consider that studies and reports developed by OECD and UNESCO about education are part of a field of expertise composed by diverse institutions, agencies, and users. This field is also of interest to a large number of people, institutions, and agencies. In these reports, mathematical knowledge and skills have taken relevance. Furthermore, international agencies give them moral attributes. For example, OECD (2014b, p. 6) asserts that:

[f]oundation skills in mathematics have a major impact on individuals' life chances [...] poor mathematics skills severely limit people's access to better-paying and more-rewarding jobs; at the aggregate level, inequality in the distribution of mathematics skills across populations is closely related to how wealth is shared within nations. Beyond that, the survey shows that people with strong skills in mathematics are also more likely to volunteer, see themselves as actors in rather than as objects of political processes, and are even more likely to trust others. Fairness, integrity and inclusiveness in public policy thus also hinge on the skills of citizens.

Consequently, documents produced by international agencies set a logic and rationality in education where mathematical knowledge and skills are of great value for the development of a "good citizen." Teachers are the key element of a quality education system to produce high results for students, measured in terms of high scores in achievement tests. Therefore, it is asserted that mathematics teachers are important for society (OECD 2005, 2010c; UNESCO, 2009). Moreover, it is recognized that to think mathematically is a powerful mean to understand and control one's social and physical reality (OECD, 2010c). Additionally, UNESCO (2007, p. 6) states that "mathematics education is a key to increasing the post-school and citizenship opportunities of young people."

If mathematical competence becomes a desired qualification, then the mathematics teacher is considered a provider and developer of certain tools and skills to new generations, which should help people to undertake diverse tasks and problems of everyday life, and of their contexts (OECD, 2010c). Mathematical knowledge is essential for society and its development (Gellert, Hernández, & Chapman, 2013; OECD, 2010d). The mathematical knowledge gets a high value in society, and thus acquires a privileged position because it conducts students' ways of thinking and acting with this knowledge.

Within discussions about teaching and learning, educational achievement is related to factors beyond education; for example, OECD (2014a, p. 104) says that "[h]igher educational achievement benefits both individuals and society, not only financially, but in the well-being with which it is also associated, such as better health outcomes and more civically engaged societies." Educational achievement becomes the aim for the development of movements and efforts realized in diverse social spheres.

Moreover, when improving achievement is at stake, teachers are the only variable that policy can touch in significant ways to better students' achievement. As a result, what happens with teachers becomes a concern for several countries, policy makers, and social and school agents. For example, Schleicher (2012) states that school leaders reported a lack of qualified teachers, particularly mathematics and science teachers. A series of other issues acquire prominence: the need of good teacher training, the improvement of professional knowledge and skills that teachers have to develop, the increase in the effectiveness and competitiveness of teachers, and the implementation of policies to retain the best teachers, among others.

UNESCO (2015) recognizes that it becomes important to ensure that teachers are well trained, motivated and supported. Additionally, Schleicher (2012, p. 38) states that:

[t]eachers need to be well-versed in the subjects they teach in order to be adept at using different methods and, if necessary, changing their approaches to optimize learning. This includes content-specific strategies and methods to teach specific content.

These reports are not alone in producing different statements of the sort. Mathematics education research literature also points out that the job of the mathematics teacher is a complex and demanding practice that requires a mixture of both theoretical and practical knowledge, skills, and deep understanding of children (White, Jaworski, Agudelo-Valderrama, & Gooya, 2013). A whole range of general and subject specific research resonates with the statements produced by international agencies.

Diverse statements about the mathematics teacher are formulated from an idealized and desired image of the teacher. However, at the same time, these statements shape an idealized and desired image of the teacher. For example, UNESCO (2007, p. 13) describes the *effective teacher*, which in turn embeds an image of the ideal teacher:

[E]ffective teachers understand that the tasks and examples they select influence how students come to view, develop, use, and make sense of mathematics [...] Effective teachers design learning experiences and tasks that are based on sound and significant mathematics;

they ensure that all students are given tasks that help them improve their understanding in the domain that is currently the focus.

The resonances between the multiple enunciations and statements produced by international agencies, research and other voices shape truths, which establish what is possible and desired. “Truth is a discursive construction, and different regimes of knowledge determine what is true and false” (Jørgensen & Phillips, 2002, p. 13). The reports—our focus here—create a new *grey-zone* (Lindblad, Pettersson, & Popkewitz, 2015) of authoritative expert knowledge located between policy and academic research, and thus the reports contribute to new truth regimes about teachers and their work. The resonances formed by a multiplicity of perceptions and understandings converge in shaping cultural theses about the mathematics teacher, configuring an ideal subject. The subject—the mathematics teacher—emerges through repetition and anticipation, and the subject is constituted in the given (Deleuze, 1991).

Hence, through the discourse analysis deployed, we seek to navigate through the discursive network, tracing and mapping the circulating enunciations and statements that constitute the framing of teachers’ subjectivity nowadays. The analysis has two movements. First, we study how the mathematics teacher is shaped as a policy product. Second, we examine how the teacher is shaped as a sales agent.

The Mathematics Teacher as a Policy Product

Navigating through OECD and UNESCO documents it is possible to identify the articulation of a certain form of reasoning and arguing. Education is an important factor in the *social and economic development of countries* (OECD, 1989). For education to deliver the adequate formation of human capital, it is important to focus on the *quality of the education system*. A quality system will secure that as many students as possible acquire the needed competencies so that *students’ achievement*, in general, can be high. Students’ achievement is systematically monitored as a strategy to closely follow educational quality. The accumulation of extensive and detailed data about the quality of educational systems in many countries in the world reveals that there are factors of quality, which cannot be directly dealt with and easily influenced—what is called contextual factors. However, there are factors that governments can steer. The one key element is *the quality of teachers and their professional development*. It is within this type of reasoning that the four elements highlighted above—development, quality, achievement, and teachers—entangle in a discursive network framing the becoming of the mathematics teacher into a policy product.

A large number of reports and studies focus on the steering of education to produce effective students’ learning and achievement. Diverse factors are recognized to have influence on *student’s achievement, learning, and experience*. The reports state that contextual factors such as different abilities, attitudes and background that the students have and bring to school are “difficult for policy makers to influence, at least in the short-run” (OECD, 2005, p. 26).

But there seems to be taken as a fact that “*the quality of teachers and their teaching*” are the most important factors in student outcomes that are open to policy influence” (OECD, 2005, p. 12, our emphasis). To conceive teachers as the targets of policy implies thinking that it is possible to design and fabricate teachers on the grounds of political ideas and agendas such as globalization and social progress. The teacher then becomes configured and controlled as a product for society to face the demands and needs of economic and political initiatives and interests.

This is connected with the emphasis in diverse documents for *the quality of the education system* and its relation with teacher’s quality performance. For example,

[a]ll countries are seeking to improve their schools, and to respond better to higher social and economic expectations [...] Teachers are central to school improvement efforts. (OECD, 2005, p. 19)

PISA shows a clear link between student performance and teacher status, with students doing better in school systems that spend more on salaries to attract quality teachers. (Schleicher, 2014, p. 11)

UNESCO also recognizes a direct relation between the quality of the education system and the teacher. They warn that:

[e]ducation quality can be jeopardized by hiring untrained teachers if they lack qualifications, preparation, motivation, appropriate working conditions and ongoing professional development. (UNESCO, 2015, p. 9)

Teachers are the key to the positive and sustainable development of education systems, constituting the principal challenge to quality mathematics education (UNESCO, 2012). Moreover, diverse investigations argue that teacher’s quality is closely related to student’s learning and his/her academic achievement (OECD, 2005); and that effective teachers help to close achievement gaps between advantaged and disadvantaged students:

[e]ffective teachers are particularly important for disadvantaged schools and their students [...] Highly competent teachers can have large positive effects on student performance, strong enough to close achievement gaps between disadvantaged and advantaged students. [...] Teachers may help low performing students to catch up and improve. (OECD, 2012, p. 130)

Thirdly, the interest in strengthening the teaching profession has the purpose of striving for the *quality, effective teacher*. The teacher is considered as the means whereby it is possible to achieve the promise of improving the education system and to reach the desired quality level. In the search of an improved educational system, teachers become a priority issue for the society because “teachers are key to increasing educational quality” (Luschei & Chudgar, 2015, p. 3).

Achievement, quality, and teachers are meant to be geared towards high quality due to their aggregated significance for *social and economic development* in countries and between countries. Schleicher (2011, p. 45) states that the conditions for the teaching profession are important:

[d]ata from Pisa show that high-performing education systems tend to prioritize the quality of teachers, including attractive compensation, over other inputs, most notably class size.

Such a statement indirectly states that low performing countries in PISA—which correspond with poor, developing countries—have problems providing good conditions for the profession. At the same time, teachers are being positioned as the key actors in bridging achievement gaps, which is also a socioeconomic gap. Hence, there emerge ideas such as the need for teachers to be given appropriate support and training for facing diversity in schools and classrooms:

School education must therefore seek to overcome socio-economic inequalities throughout societies while at the same time utilise the benefits that diversity brings to schools and classrooms. A successful programme treats diversity as a source of potential growth rather than an inherent hindrance to student performance. One way to do this is to use teachers' strength and flexibility. Of course, for this to be effective, teachers need to be given appropriate support and training. (OECD, 2010a, p. 20)

In many countries, there is a high demand and need for qualified teachers. UNESCO (2007, p. 69) urges for the “need for better-trained mathematics teachers,” that is, teachers trained with the highest standards of professional knowledge, skills, competence, and integrity; and teachers who must and can implement diverse initiatives to improve teaching. Such an effort is set as a priority in a context where “about half the countries report serious concerns about maintaining an adequate supply of good quality teachers, especially in high-demand subject areas” (OECD, 2005, p. 8).

Countries which have improved their performance in PISA have also set policies to improve their teaching staff (OECD, 2013b). Moreover, several high-performing countries took decided steps to raise the quality of the teaching profession—for instance, by inspiring people from other professions to give their talents to the teaching profession. Through marketing, for example, diverse recruitment campaigns can emphasize the fulfilling nature of teaching as a profession, and can attract candidates (OECD, 2014d). Such initiative is important because it is recognized that high performing countries, unlike other countries, recruit their candidates for initial teacher training from the top third of each cohort that graduates from their school system (OECD, 2010b). It is important to attract good candidates with potential for being a teacher as the raw material for the fabrication of the teacher. The recurrent idea concerning recruitment is that the better the candidates, the better the teachers. The teaching profession is thus being portrayed as “the option” for fulfilling and satisfying social demands and requirements. The satisfaction of societal needs and desires is secured through the configuration, use, and consumption of the object called “teacher.”

However, good raw material is not enough. Teachers' continual professional development also promotes the social and economic development of a country. The retention of teachers is important: “Teacher policy needs to ensure that teachers work in an environment that encourages effective teachers to continue in teaching” (OECD, 2014a, p. 486). The instruments to secure recruitment go hand in hand with instruments to monitor the good quality of teachers' professional exercise and its improvement. For example, permanent evaluation of teachers, involvement in lifelong learning activities, and the monitoring of students' achievement are becoming control instruments for policy. Currently, it is needed to submit the teacher to constant testing with

the aim of knowing if s/he is or is not competent. In other words, “quality control” becomes a constant measurement that the teacher must face. It is recognized that initial teacher training—whether good or bad—does not really matter, since it cannot prepare teachers to succeed in every challenge throughout a career (Schleicher, 2012, 2014). For example, in situations where there is “socio-economic heterogeneity in student populations, this heterogeneity is a major challenge for teachers and education systems” (OECD, 2014c, p. 36). Policies “should be implemented to ensure teachers have sufficient qualification and training” (UNESCO, 2015, p. 9).

The different lines that we tried to follow in the previous paragraphs cross, ensemble and intermesh. In the discursive network where the lines unfold there operates the mechanism where the teacher is controlled, produced and planned in function of what is desired by society. Moreover, the teacher is positioned in a market logic where supply and demand configure the teacher as a product that can be made and acquired by whoever has purchasing power. This favours a logic where the higher the purchasing power, the better teachers may be produced.

In this discursive network the mathematics teacher is configured as a political product, a product that results from policies. The market and society seek to satisfy the needs and desires that are established as urgent, through the making of the teacher. Moreover, the market—and its hunger for highly mathematically competent workforce—sets the attributes that the mathematics teacher must have, and thanks to globalization these attributes seem to be standardized. The mathematics teacher as a product of policy is subjected to the whims of the market, the development of policies, and the response to social demands.

The Mathematics Teacher as a Sales Agent

In the documents of international agencies there is a substantial concern about the development of mathematical knowledge in young people, and thus the teaching and learning of mathematics. This concern is expressed through attention on achievement of children, adults, teachers and even social achievement. Achievement is mainly measured through standardized tests, for example, PISA and Trends in International Mathematics and Science Study (TIMSS). Through the quantification of achievement, it is possible to know the level, competencies and expertise in mathematics that countries, groups or individuals have. It is argued that mathematics achievement is relevant since modern societies require a high level of mathematical competence for social development. Mathematics is referred to as the foundation of much of the scientific and technical activity that distinguishes advanced from less advanced societies, hence, “developing students’ mathematical competence at a much higher level than is required for everyday communication is thus a goal of most school programs” (OECD, 2010c, p. 32).

In OECD and UNESCO documents mathematics achievement is set in a network of at least three lines: *social and economic differences, teaching and learning mathematics, and students’ and teachers’ performances*. Mathematics achievement

is configured as a node, where the lines conducting the mathematics teacher in the discursive network converge. The mathematics teacher as a sales agent is a multifaceted salesman/woman. S/he must not only manage the mathematics teaching, but also, among others, the students, their motivation, experience, and expectations. The teacher must identify social needs and design offerings adjusted to the context according to the standards set for the product s/he is dealing with. S/he must be capable of promoting and selling a highly valued product—the mathematical knowledge and competence. Finally, the mathematics teacher becomes a defender for progress and success in society. The progress promised by this highly qualified agent is based on his/her capacity of developing of mathematical knowledge in students.

Firstly, within diverse documents of international agencies, it is possible to identify an interest in studying how *social and economic differences* in students and of countries constitute gaps in levels of performance. It is asserted that there is a direct relationship between students' social and economic background and their achievement, particularly in mathematics achievement. For example:

On average, a more socio-economically advantaged student scores 39 points higher in mathematics than a less-advantaged student. This difference represents the equivalent of nearly 1 year of schooling. (OECD, 2013a, p. 17)

On average across OECD countries, 13 % of students are top performers in mathematics (Level 5 or 6). At the same time, 23 % of students in OECD countries, and 32 % of students in all participating countries, are low performers in mathematics (i.e. they did not reach the baseline Level 2). [...] Across OECD countries, 15 % of the difference in performance among students is explained by disparities in students' socio-economic status [...] around 1 year of formal schooling—separate the mathematics performance of those students who are considered socio-economically advantaged and those whose socio-economic status is close to the OECD average. (OECD, 2014a, p. 189)

Socio-economic measure is positively associated with mathematics performance in all countries. (OECD, 2010c, p. 76)

OECD and UNESCO studies have shown the differences that there are between countries and the differences that exist within each society or community that has been studied. These studies converge mainly on the concern to reduce the gap that emerges from social and economic differences. Here, the mathematical knowledge—its teaching and learning—has acquired a value in society, and the mathematics teacher is responsible for promoting the increased and improved acquisition of better mathematical knowledge. The mathematics teacher must guaranty that this knowledge comes to society; in other words, the teacher is positioned as the one who must sell and ensure massive consumption of this desired merchandise.

The results from studies that recognize social and economic differences generate antecedents for policy makers. OECD (2014a, p. 188) states:

PISA results reveal what is possible in education [...] The findings allow policy makers around the world to gauge the knowledge and skills of students in their own countries in comparison with those in other countries, set policy targets against measurable goals achieved by other education systems, and learn from policies and practices applied elsewhere.

Moreover, from successful experiences there emerge guidelines that set an ideal image of what is desired from the educational system, its functioning and participants. The OECD country reports clearly express this type of logic. For the case of Sweden, one of the countries whose performance in PISA tests declined dramatically in 2012, it is stated:

The report makes extensive use of OECD's international knowledge base and of Swedish educational research, statistical information and policy documents. It identifies the main strengths and challenges of the school system and provides concrete recommendations and policy actions to serve as the foundation for a comprehensive school improvement reform to bring about system-wide change and strengthen the performance of all Swedish students [...] (OECD, 2015, p. 14)

OECD Education Policy Reviews are tailored to the needs of the country and cover a wide range of topics and sub-sectors focused on education improvement. The reviews are based on in-depth analysis of strengths and weaknesses, using various available sources of data such as PISA and other internationally comparable statistics, research and a review visit to the country. They draw on policy lessons from benchmarking countries and economies, with expert analysis of the key aspects of education policy and practice examined [...] The methodology aims to provide analysis and recommendations for effective policy design and implementation. It focuses on supporting reform efforts by tailoring comparative analysis and recommendations to the specific country context, engaging and developing the capacity of key stakeholders throughout the process. (OECD, 2015, p. 15)

The recommendations of OECD to Sweden on how to create a “highway” to educational success (Lindblad et al., 2015, p. 137) highlighted the importance of designing targeted strategies for promoting better learning for all and for disadvantaged groups, and for raising the quality of teacher education and the teacher profession. The documents create clear images that are then sold around as effective solutions to fix the problems of education, by deploying different marketing tools for the consumption of the educational products of these agencies.

Secondly, in order to talk about mathematics achievement it is essential to focus on *teaching and learning mathematics*, since “it is clear that teaching and learning factors have a significant association with student performance in mathematics” (OECD, 2010c, p. 120). Furthermore, “there is a strong correlation between the teacher’s knowledge of mathematics and successful classroom practice” (JMTE, 2014, p. 373). “The presence of qualified, well-motivated and supported teachers is vital for student learning. Effective teaching strongly influences what and how much students achieve in school” (UNESCO, 2015, p. 1).

Mathematical literacy is configured as an important issue in teaching and learning mathematics. It is relevant that people have mathematical skills and knowledge, but it is also important to know what can be done with these skills and knowledge. In OECD (2014a) it is enunciated that modern societies valorise individuals not for what they know, but for what they can do with what they know. Some OECD documents defend the relevance of mathematical literacy for society. For example:

Mathematical literacy is an individual’s capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. It assists individuals to recognise the role that mathematics plays in the world and to make the wellfounded judgments and decisions needed by constructive, engaged and reflective citizens. (OECD, 2010d, p. 4)

The statements around this line contribute to set up the idea of the mathematics teacher as a sale agent promoting the education of a subject—the desired student (see also Andrade-Molina and Valero in this volume)—through the conduction of students' conduct and behaviour in learning mathematics and becoming mathematically literate. Hence, the teacher is portrayed as an agent for governing, subjecting and conducting children through mathematical learning.

Finally, it is possible to identify some policy initiatives around the teaching and learning focusing on the *improvement of teachers' and students' performance*. Students' mathematical achievement is recognized as “the educational outcome, student learning strategies and teaching strategies are its main predictors” (OECD, 2010c, p. 70). Teaching strategies and student learning strategies are characterized by OECD (2010c, p. 20) as:

[t]eaching strategies refer to a broad range of processes, from the organisation of classrooms and resources to the moment-by-moment activities engaged in by teachers and students to facilitate learning. Student learning strategies refer to cognitive and meta-cognitive processes employed by students as they attempt to learn something new.

In OECD (2014a, p. 196), it is considered that:

[t]op performers in mathematics are students who score at Level 5 or 6 on the PISA assessment. They can develop and work with models for complex situations, identifying constraints and specifying assumptions; select, compare, and evaluate appropriate problem-solving strategies for dealing with complex problems related to these models; work strategically using broad, well-developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterisations, and insight pertaining to these situations; and begin to reflect on their work and formulate and communicate their interpretations and reasoning.

High performance is of great interest for societies. “Student performance in mathematics is related to teachers' professional knowledge of mathematics, that is, their knowledge of mathematics per se, and the specialised knowledge of mathematics used in teaching” (UNESCO, 2012, p. 74). Regarding teacher's knowledge, research on mathematics teachers states that:

[a]dditional research is needed to understand the relationship between [...] knowledge and pedagogical moves. It is necessary, as part of the development of a robust theory of the knowledge teachers need, to understand how teachers' learning with understanding fits into teaching for understanding in their classrooms. (JMTE, 2015, p. 295)

The whole issue of the subject-matter qualifications of teachers is also highlighted as being of great importance. It is possible to identify some policy initiatives that have as aim to attract teachers in subjects such as mathematics, science and technology (Schleicher, 2011). The quality and effectiveness of teachers take relevance within social spheres:

[t]eachers need to be capable of preparing students for a society and an economy in which they will be expected to be self-directed learners, able and motivated to keep learning over a lifetime. (OECD, 2005, p. 97)

Moreover, OECD (2014a, p. 18) recognizes that the professional development of teachers is politically relevant:

[p]olicy levers and contexts typically have antecedents—factors that define or constrain policy [...] For teachers and students in a school, for example, teacher qualifications are a given constraint while, at the level of the education system, professional development of teachers is a key policy lever.

Currently, students need to have an understanding of the fundamental concepts of mathematics. They need to be able to cope with a new situation or problem, recognizing the relevance of mathematics, identifying and using the relevant mathematical knowledge to solve the problem, and evaluating the solution in the original problem context (Schleicher, 2012). In addition, the mathematics teacher must be able to make sure that students will be able to do all these activities. The work of the teacher is more than teaching mathematics; rather the mathematics teacher must contribute to give value to mathematical knowledge for everyday life and for the future.

As a result, the teacher is a medium that extends and realizes the intentions of policy, for example, through the promotion and implementation of reform. Promoting reform is “considered by many to be a major responsibility of prospective teacher preparation” (JMTE, 2014, p. 295). S/he is made a sales agent that must favour a more equal and just society. The mathematics teacher is responsible for promulgating the desire for mathematics.

The Making of the Teacher Within a Dispositive of Control

Following the traces of enunciations and statements about the acclaimed and undoubted importance of teachers for building the future in documents of international agencies such as OECD and UNESCO, we entered an entangled discursive network where lines and forces cross. In our analysis a certain sense of repetition and circularity intended to grasp the folds and unfolds of the multiple stories told about who teachers are and who they should be. These stories are instantiations of power. Possible subjectivities become actualized in the discursive network (Jørgensen & Thomassen, 2015) unfolded by the prominent and increasingly decisive expert-knowledge of these agencies. It is precisely in the actualization of power in discourse and stories that possible cultural theses about the mathematics teacher emerge. Teachers’ subjectivity is framed and entangled in a rationality of social progress, competitiveness, and globalization. The double bind of the mathematics teacher as a policy product and as a sales agent is made concrete in the demands and expectations of society and in the urge of making (mathematics) education work for the economy.

In our previous analysis the connection between these discourses and particular economic interests and agendas have been hinted at. In our conclusion we want to make such connection more explicit by opening up the political field of subjectification of which the network of discourses on the (mathematics) teacher is made possible. Deleuze’s notion of *dispositive*—congruent with Foucault’s notion of apparatus—helps us casting light on this issue. Foucault (1980, p. 195) wrote:

I understand by the term “apparatus” a sort of—shall we say—formation which has as its major function at a given historical moment that of responding to an urgent need. The apparatus thus has a dominant strategic function. This may have been, for example, the assimilation of a floating population found to be burdensome for an essentially mercantilist economy: there was a strategic imperative acting here as the matrix for an apparatus which gradually undertook the control or subjection of madness, sexual illness and neurosis.

A dispositive—a “tangle, a multilinear ensemble” (Deleuze, 1992b, p. 159)—can be understood as a machine, which makes one see and speak (Deleuze, 1992b). A dispositive is immersed in the network of relations that can be established between “discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions—in short, the said as much as the unsaid” (Foucault, 1980, p. 194).

A dispositive making the teacher a policy object and a sales agent operates as a response to the urgent need expressed in different institutions and by expert knowledge producers, of securing a world order where education is meant to bring individual prosperity, collective competitiveness and international circulation of well-being, all following the patterns of those who are on the top of the rankings of wealth and progress. The making of mathematics teachers cannot longer be left to the whims of a single person's dream of teaching his/her favourite school subject, or of well-intentioned teacher education programs. Governments need to steer and secure the adjustment of a machinery to make the right agents of the desires of the state—which, by the way seem to conflate with the needs of the market.

The demands of the time are embedded in the different lines that we addressed in our analysis and in the ways they intersect: quality teachers and effective teachers are needed with the aim of closing gaps between students' achievement, professional development, and social and economic differences. For achieving this goal, teachers' professional development takes on particular relevance, since it secures compliance with what the ideal desire about who the mathematics teacher must be, and what s/he must do. The mathematics teacher needs to develop specific skills and knowledge, so that s/he can respond to central urgencies of society. But, how is it possible to ensure that the teacher has developed what is necessary or what is demanded? Here is where the continuous training and, specifically, standardized tests acquire importance. The highest mechanism of control in the education system is the use of standardized tests. These tests are setting a numerical language of control that marks access to information, and where people have become samples, data, or markets (Deleuze, 1992a). Hence, the test that measures students' performance and directly or indirectly teachers' quality and, as a whole, educational quality allows transforming education into controllable variables of a system attending a marketing logic.

Marketing has become the center or the “soul” of the corporation [...] the operation of markets is now the instrument of social control and forms the impudent breed of our masters. Control is short-term and [...] continuous and without limit, while discipline was of long duration. (Deleuze, 1992a, p. 6)

The market sets supplies and demands around the mathematics teacher to satisfy social needs. There is always a demand determining what the teacher should know

to satisfy the requirements of society, and these demands shape the double bind of the teacher: the teacher as a policy product is fabricated with the aims of meeting social demands and requirements, and as a sales agent is configured for conducting students towards the desires of society. The double bind increases the demands of professionally qualified teachers against the lack of them, which in turn installs a strong logic of competition. This logic implies that the teacher does not only need to compete in qualifications with other teachers to get a job; it is necessary to compete permanently with oneself for staying in the job, even in a situation when the person is highly needed. Secondly, and as a consequence of the previous, the focus is on the knowledge and skills of the mathematics teacher. These knowledge and skills must comply with special requirements of quality and expectations established by society. In research on mathematics teachers it is recognized that “[teachers need to] develop professional knowledge in support of their practice” (JMTE, 2014, p. 455). It is also pointed “that teachers’ lack of content knowledge interfered with their judgements and that there [is] a mismatch between their perceptions of students’ difficulties and the actual difficulties demonstrated by their students” (JMTE, 2014, p. 405). Hence, demands and social urgencies promote discourses and forces for establishing the idea of permanent training since it is recognized that initial teacher education is insufficient to satisfy new challenges that market sets. However, why did the need for permanent training and what is being sought with it emerge? A partial answer can be found in Deleuze (1992a, p. 4), who argues that:

[i]n the societies of control one is never finished with anything—the corporation, the educational system, the armed services being metastable states coexisting in one and the same modulation, like a universal system of deformation.

Therefore, the idea of permanent training is a way of maintaining control of a never-ending process for the teacher. The idea of permanent training is operating as part of a dispositive by setting diverse forms of control, discourses, and forces. Consequently, the mathematics teacher is condemned to be incomplete and to have constant deficits to overcome, since society and the market will always be setting new requirements, demands, and urgencies that the teacher must face. The mathematics teacher will always be “a man in debt” (Deleuze, 1995, p. 181).

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Montecino, A., & Valero, P. (Submitted). The desired mathematics teacher: mapping and problematizing the discourses in JMTE. *Journal of Mathematics Teacher Education*.

The Desired Mathematics Teacher: Mapping and Problematizing Discourses in JMTE

Alex Montecino and Paola Valero

The aim of this paper is to map and problematize the discursive network in which the desired mathematics teacher is shaped. The tools of *network analysis* and *discourse analysis* are put in operation for opening a qualitative study of resonances and relationships of predominant discourses (re)produced in the Journal of Mathematics Teacher Education, in specific, the articles published between 2011 and 2015. Truths and dominant narratives about the desired mathematics teacher, entangled in the research, are unpacked.

INTRODUCTION

Research on mathematics teachers has been an expanding area of mathematics education and it has become a major strand of the field of research in the last two decades (Kilpatrick, 2014), which has configured *the era of the teacher* (Sfard, 2005). Such expansion is evident in the extent of publications in journals, special issues and in conference study groups that have had as focus different aspects of mathematics teachers and their training. Besides the constant and successful publication of this very same journal—JMTE—, the *International Handbooks of Mathematics Education*, published in 1996, 2003, and 2013, contains 14 chapters addressing teachers' professional knowledge, the relationship between teacher education and teachers' practices, teachers' participation in research, teachers' use of technologies, teachers' use of assessment, teachers' professional development, and teachers' learning. And the *International Handbook of Mathematics Teacher Education*, published in 2008, contains research addressing “the learning of mathematics teachers at all levels of schooling to teach mathematics, and the provision of activity and programmes in which this learning can take place” (Wood, 2008, p. ii). At the same time, there is a growth of study groups on teachers in international conferences such as ICME and CERME³, or international collaborative

³Within of 38 Topic Study Groups of ICME11 (2008) only 2 groups explicitly addressed some issue regarding the mathematics teacher, in ICME13 (2016) is possible to find 4 of 54 groups focused in the teacher. Something similar has occurred in CERME, 1 of 17 Thematic

studies, for example, the ICME 10 Survey Team (see Adler, Ball, Krainer, Lin, & Novotna, 2005; Robutti et al., 2016) and the ICMI Study 15 on teachers' education and development (see Even & Ball, 2009). In addition to international comparative studies of mathematics teacher education, such as *Teacher Education and Development Study: Learning to Teach Mathematics (TEDS-M)* (Blömeke, Hsieh, Kaiser, & Schmidt, 2014).

The expansion of research on the mathematics teacher is not simply a trend emerging from the internal, scientific advancement of mathematics education research. Such expansion goes hand in hand with the vested interest of stakeholders, including policymakers, teacher educators, parents and teachers themselves, in identifying and ensuring high-quality teachers and teaching (Jong & Hodges, 2015, p. 407). Teachers have been identified as a central element in the recent trend of expert-driven and evidence-based improvement and provision of quality education. As a result of systematic, large-scale studies on “what works” to bring the desire of educational improvement to reality, OECD has established that ““teacher quality” is the single most important school variable influencing student achievement” (OECD, 2005, p. 26). Teachers are explicitly considered “objects of policy”; they are the one factor that can be molded through national policies for securing the betterment of educational systems (OECD, 2005). Increasing students' results in national and international measurements of achievement is an indication of the improvement of the system and of teachers' quality. However, this is not enough, the improvement of teachers' quality—that results in improved students' performance—is also considered a matter of *equity* since “[e]ffective teachers are particularly important for disadvantaged schools and their students[...] Highly competent teachers can have large positive effects on student performance, strong enough to close achievement gaps between disadvantaged and advantaged students” (OECD, 2012, p. 130). In other words, there is a series of connections between the quality of teachers and the overall improvement of individuals, communities, nations, and their possibilities. Also, in the long run, improved economic possibilities through the development of education and of mathematics education in particular (OECD, 2014a, 2014b) are part of the reasons for highlighting the necessity of rocketing the quality of mathematics teachers.

The ideas about how the mathematics teacher should be, and what s/he should know and be able to do to be considered a “good” teacher have changed through time, not only in research but also in society. These two domains actually intertwine when it comes to the formulation of desired teachers and of how they need to be governed to become the cornerstone in the education of the new generations. The use of expert

Working Group Teams of CERME7 (2011) explicitly addressed the mathematics teacher, which has increased in CERME10 (2017), where 3 of 24 groups are focused in the teacher.

and scientific knowledge in devising technologies and strategies of government is one of the main characteristics of power in Modernity, what Foucault called *power/knowledge* and, in his later work, *governmentality*, or the conduction of conducts, through different forms of knowledge in which power effects and particular forms of subjectivity are possible (Foucault, 1980, 1991 [1978]). Teacher education is not an exception. Indeed, one of the first moves of young nation states during the 18th and 19th centuries to create national identity was getting hold of the education of teachers. Teachers were embodying the pastoral power and salvation narratives spreading in the population the set of values and new habits of body and mind needed in the consolidation of the state. The Prussian system of teacher education is maybe the best example of this move (Tröhler, 2012). Nowadays, within research, it seems as if the *political* in teacher education has been blurred by the increased scientification of the field of teachers' practices and education. The scientific outlook does not change the fact that teachers are "objects of policy"; it just changes the power/knowledge relationships in which teachers are constituted.

Our contribution in this paper is advancing socio-political studies on mathematics teachers, which are scarce in the field of mathematics education (Gates & Jorgensen, 2009). We put the gaze on how research on teacher education is a field of power/knowledge where particular notions of the desired teacher emerge, and thus becomes part of the technologies of government that have power effects on teachers. Through a quali-quantitative strategy that articulates *network analysis* and Foucauldian *discourse analysis*, we examine discourses that circulate in six years of JMTE. We focus on the statements⁴ that enunciate what characterizes the desired and feared mathematics teacher, by embodying a double gesture in which teachers' subjectivities are constituted. We argue that the constitution of the mathematics teacher and his/her ways of being and doing are shaped, controlled and disposed through the establishment of a discursive network that (re)produces particular notions of the "good teacher", as well a particular rationality within which the teachers are thought and understood. The purpose of such analysis is problematizing the directions in which such notions govern the fabrication of teachers' subjectivity, and arguing about the ethical and political commitments of such discourses and the notion of good teacher that they produce.

We start by presenting the analytical framework, which guides our exploration. Then we map the network of statements that make part of the discourse on the good—desired—mathematics teacher identified in the empirical material. The

⁴ A statement is neither a sentence nor a proposition, which cannot be reduced to language or logic, "a statement is always an event that neither the language (*langue*) nor the meaning can quite exhaust" (Foucault, 1972, p. 28), the statement has an enunciative function. In this fashion, "discourse can be defined as the group of statements that belong to a single system of formation" (Foucault, 1972, p. 107).

exploration of key elements of the network is presented in an attempt to start a problematization of the dominant narratives, its truths about the desired mathematics teacher and the ways in which the mathematics teacher is thought and understood.

RESEARCHING MATHEMATICS TEACHER RESEARCH

This paper is not to review mathematics teacher research; other contributions have offered such overview (e.g. Lerman, 2001; Stahnke, Schueler, & Roesken-Winter, 2016). Rather the intention is to carry out *research on research* (Pais & Valero, 2012), an analytical strategy that evidences how mathematics education research effects power through the production of notions about desired kinds of people and, at the same time, implicit notions of the types of people who are feared. This double gesture constitutes an important technique for governing subjectivities through knowledge as Foucault (1991 [1978]) has pointed out, and as Popkewitz (2011, 2013) has shown for educational research and research on teachers. Researching research is, in this case, a political and critical move to identify the discourses within which notions of the good mathematics teacher are formed. This move allows us problematizing how research contributes to the creation of ways of thinking about the mathematics teachers, their practices, and education, as well as questioning how mathematics teachers' conduct is formed and regulated through researching practices.

Some key theoretical tools connected to analytical moves have been important in this study. The concept of *teachers' subjectivity* here does not refer to the identity of individuals, but to the meeting of teachers with the notions of who they should be and how they should act. The latter is articulated in and through the discursive network, in which have been circulated diverse systems knowledge such as research. Subjectivity as an effect of power points to how categories of reflection generated in scientific practices *fabricate* different possible desired subjects (Popkewitz, Diaz, & Kirchgasler, 2017). In this sense, mathematics teacher research operates conducting the teacher's conduct, what Foucault named governmentality.

The *discursive network* refers to the associations and groupings of a particular kind of statements, which generate notions of the good teacher and have effects on subjects and their ways of thinking and acting, as previously discussed. Moreover, these statements and its notions articulate taken-for-granted truths, which are supported by a whole range of practices and institutions (Foucault, 1972). We are understanding truths as discursive constructions unfolded in different regimes of knowledge (Jørgensen & Phillips, 2002, p. 13). In words of Foucault (1980)

'Truth' is to be understood as a system of ordered procedures for the production, regulation, distribution, circulation and operation of statements. 'Truth' is linked in a circular relation with systems of power

which produce and sustain it, and to effects of power which it induces and which extend it. A ‘regime’ of truth. (p. 133)

In our case, the truths about the good mathematics teacher are embodied in the ideas used to articulate teacher education, professional development, and policy making for achieving good quality teachers.

Furthermore, discourses are not generated out of the scientific discoveries of the authors of research texts. Rather, research texts reveal the convergence of a complex network of discursive practices, namely “the function of an author is to characterize the existence, circulation, and operation of certain discourses within a society” (Foucault, 1977, p. 124). This means that whenever researchers write about their findings, they always do so within the restrictions of institutional systems and organizations that determine what is possible to say (Foucault, 1972). Therefore, the analysis performed here is focused on statements that repeatedly circulate in research, and not on the authors who formulated the statements. This is reflected in our choice of citing the empirical material for illustrating the recurrences using the form (JMTE, year, page).

In order to reveal the network of statements in circulating discourses about the mathematics teacher, the empirical material was delimited, consisting of 171 publications (141 original papers and 30 editorial notes) published between 2011 and 2016, in the *Journal of Mathematics Teacher Education* (JMTE). We selected this period—6 years—because it contains papers with a diversity of authors, ways of arguing, perspectives, and research topics. This period represents about one third of the journal publications, and shows a current view about what is known about teachers’ practices, knowledge, education, achievements, and needs for improvement. JMTE is positioned internationally as a high-impact journal within mathematics education research. In concordance with a study of journals’ quality in mathematics education based on citation and opinion, JMTE is ranked in the sixth position according to the citation-based study, and ranked in the fifth position according to the opinion-based study, being categorized as a high quality journal (see Williams, 2017). Moreover, by using Google Scholar tool metrics to know the visibility and influence of recent articles in scholarly publications, it is possible to see that JMTE is located in fourth position when searched ‘mathematics education’ (its h5 Index⁵–2016 is of 21). In the same light, when comparing diverse metrics of

⁵ “Google’s h5 Index is a metric based on the articles published by a journal over the previous 5 calendar years with a minimum of 100 articles in this period. If a journal publishes 100 articles sooner, an h5 Index can be calculated earlier. h is the largest number of articles that have each been cited h times. The h5 Index therefore cannot be dominated by one or several highly cited articles” (Journal of Mathematics Teacher Education, Journal Metrics 2016, http://static.springer.com/sgw/documents/1621627/application/pdf/10857_Journal+Metrics_2016_flyer.pdf)

JMTE with other journals in the field, its relevance is evident: the SNIP ⁶-2016 of JMTE is of 1.317, the Journal for Research in Mathematics Education (JRME) has a SNIP-2016 of 2.00, and the Educational Studies in Mathematics (ESM) has a SNIP-2016 of 1.788. The SJR ⁷-2016 of JMTE is of 1.041, of JRME is 2.167, and of ESM is 1.228.

In the same way as Foucault (1972), our interest is not to (re)construct chains of inference for unifying the development of ideas. Rather, it is to describe *systems of dispersion* between statements and to seek for regularities there. Hence, it would not try “to isolate small islands of coherence in order to describe their internal structure; it would not try to suspect and to reveal latent conflicts; it would study forms of division” (Op cit., 37). That is, it “must recognize discourse as a ‘corpus of statements’ whose organization is relatively regular and systematic” (Arribas-Ayllon & Walkerdine, 2008, p. 100). Consequently, for analyzing the empirical material, we performed two types of analysis. Firstly, a *Foucault-inspired discourse analysis* (Arribas-Ayllon & Walkerdine, 2008; Jørgensen & Phillips, 2002) The analysis allowed identifying the repetition of statements, which describe the “rules, divisions, and, systems of a particular body of knowledge” (Arribas-Ayllon & Walkerdine, 2008, p. 99). Secondly, a *network analysis* offered a quantitative mapping of the relationships (interactions and co-occurrences) among the circulating statements. Applying tools of social network analysis “can be of use in order to perform analyses of discursive relations” (Lindgren, 2016, p. 348), since the calculations of relationships between discursive units allow mapping the discursive network that circulates in the empirical material, showing graphically the occurrences of statements, their convergence, and relationships (co-occurrences). Within the *network analysis*, the graph could be interpreted as a discursive field or space wherein its components or concepts are positioned in relation to each other (Lindgren, 2016),

grasp[ing] the statement in the exact specificity of its occurrence;
determin[ing] its conditions of existence, [... in order to] establish its

⁶ “Source Normalized Impact per Paper (SNIP) measures contextual citation impact by weighting citations based on the total number of citations in a subject field. The impact of a single citation is given higher value in subject areas where citations are less likely, and vice versa” (Journal of Mathematics Teacher Education, Journal Metrics 2016, http://static.springer.com/sgw/documents/1621627/application/pdf/10857_Journal+Metrics_2016_flyer.pdf)

⁷ “SCImago Journal Rank (SJR) is a measure of scientific influence of scholarly journals that accounts for both the number of citations received by a journal and the importance or prestige of the journals where such citations come from” (Journal of Mathematics Teacher Education, Journal Metrics 2016, http://static.springer.com/sgw/documents/1621627/application/pdf/10857_Journal+Metrics_2016_flyer.pdf)

correlations with other statements that may be connected with it, and show what other forms of statement it excludes (Foucault, 1972, p. 28).

Through the study of nodes, convergence of such graphs could reveal regimens of truth and predominant ways of arguing, thinking and understanding about the teacher. In regard of the usage of network analysis, Cecco, dos Santos Bernardi, and Delizoicov (2017) study social and intellectual networks that can be drawn through analyzing the papers published between 1985 and 2015, on mathematics teachers' training in BOLEMA, a highly ranked mathematics education journal. They recognize that is necessary and productive to understand how the production and socialization of knowledge about mathematics teachers' training operate.

The analytical strategy deployed in our researching research was deployed in four steps, which we explain below.

MANAGING AND READING OF PAPERS

The empirical materials, 171 JMTE articles, were uploaded to Nvivo⁸ in order to manage the reading and the analysis of such extent data. The reading of the articles was made through the software and by using the tools provided by Nvivo. More precisely, each paper was read once uploaded to Nvivo, and statements were manually selected and labeled. By deploying an *intensive reading* (Deleuze, 1995) of the empirical material, we seek to map all the statements that shed light into the image of the desired—good or ideal—mathematics teacher. The mapping entails locating these statements and labeling them according to key words—for example, knowledge, deficit, attributes, context, amongst others. It is important to mention that one statement could have multiple labels. For example,

Teachers not only need to know the content but also understand the kind of reasoning that is entailed in doing mathematics. They should be able to interpret student work in light of what students already know and the tools at their disposal. Additionally, teachers' dispositions to see students as sense makers and to learn the intellectual and professional stance of inquiry are important aspects of teachers' learning in and from their practice in the context of a professional community(...) Finally, a repertoire of moves and tools could support teachers' beginning enactment of important aspects of instruction (JMTE, 2016, pp. 83-84).

Different labels were assigned to this fragment, for example: *Deficits*, *Knowledge*, *Repertoire of Techniques for Teaching*, *Personal Attributes*, and *Repertoire of Administrative Technique*. Afterward, we categorized the labels assigned to fragments to move onto a more detailed analysis of the data.

⁸ NVivo is a data management tool that allows to organize, store and retrieve large data. (<http://www.qsrinternational.com/nvivo/what-is-nvivo>)

EMERGING CATEGORIZATION

The aforementioned statements were labeled and grouped into clusters. According to those clusters and to their frequencies, ten categories were established constituting six groups of categories. The first group gathers statements about the mathematics teacher's *knowledge*. It is possible to identify three kinds of statements that enunciate features of the mathematics teacher's knowledge: (a) statements that argue about and make use of *Pedagogical Content Knowledge* (PCK); (b) statements that refer to *Mathematical Knowledge for Teaching* (MKT); and (c) statements that express the mathematics teacher's *knowledge* in general terms or connected to other frameworks that are not PCK and MKT, or to an implicit framework.

The second group considers statements that refer to mathematics teachers' *repertoire of techniques*. In other words, the set of abilities and tools that the mathematics teacher should be able to display, perform, or manage. The statements that conformed this group are of two kinds: (a) statements that enunciate the *repertoire of techniques for teaching*. This group clustered those statements concerned with everything the teacher needs to put in operation while teaching, for example, skills for integrating the students, tools for the explanation, the planning and management of lessons, strategies and methods for teaching, among others. And (b) statements that enunciate the *repertoire of administrative techniques*. This category is composed by those statements that refer to everything the teacher has to put in operation to an administrative level, outside the classroom, such as, relationships with peers, co-operation and teamwork, among others.

The third group covers statements about the mathematics teacher's *personal attributes*, such as his/her beliefs, motivations, attitudes, reflection, affection, dispositions, preconceptions, among others. The main reason for gathering all enunciations that refer to some personal attributes of the mathematics teacher is because each one of these in isolation—beliefs, motivations, attitudes, reflection, affection, dispositions, preconceptions, among others—will have very “little weight” or frequency by themselves. The fourth group clusters statements that contribute to positioning the mathematics teachers in a *social context*. The statements that composed this group constituted two categories: (a) Sentences formulating the mathematics teacher as part of a *social context* and (b) sentences voicing that mathematics teachers have to *respond* to particular social context. The fifth group brings together those statements about the mathematics teacher's *deficit*. More precisely, all statements asserting that mathematics teachers have to improve, change, or develop something for fulfilling social requirements. The sixth group gathers statements referring to the mathematics teacher's *effectiveness*, no matter the nature of statements.

VISUALIZATION

The following step consisted in visualizing the categories. Nvivo was used to create two matrices from the analysis. These matrices were double-entry tables as seen below,

	Deficits	MT's Knowledge	MKT	PCK	Repertoire of Techniques for Teaching	Repertoire of Administrative Technique	Personal Attributes	Mathematics Teacher is part of Social Context	MT Respond to Context	Effectiveness
j001										
j002										
j003										
j004										
...										

The columns are constituted by the categories and the rows are each paper.

The first matrix created represents the frequencies of all ten categories on each text that compose the empirical material—that is, the distribution of statements into the categories of analysis. The second matrix created represents the co-occurrence, in other words, the distribution of the relationship between two or more categories. The relationship among categories occurs when these—the categories—are located in the same statement.

Gephi, a network analysis illustrator software, was used for graphing both matrices retrieved with Nvivo—the matrix of frequencies and the matrix of co-occurrences. The first graph, *the recurrence field graph* (figure 1), shows the frequency distribution of each category—the size of the nodes—, but also, it portrays the “relation of forces” between nodes—the position of each node within the graph. If one node is located at the center implies that its relation of forces is stronger. If one node is located towards the border implies a less strong relation of forces. The second graph, *the network of co-occurrence graph* (figure 2), shows the relationship between categories within the same statement. These relationships configure a community—color of the nodes—, and the frequency with which the categories are related with each other—the size of the nodes and the weight of the edges⁹. The communities and the relationship between categories embody circulating discourses or dominant narratives, in Foucauldian terms. The third graph, *the network of filtered co-occurrence graph* (figure 3) shows the main dominant narrative circulating through JMTE articles, its configuration and relations—five nodes and seven edges that result from the filtration process. This dominant narrative about the mathematics teacher has as cornerstones: *Deficit*, *the Repertoire of Techniques for Teaching*, and *Knowledge* (MKT, PCK, and MT'sK).

⁹ Edges are the “lines” or “links” between two nodes, and their weight is represented by the lines’ width

The first graph was generated by using *Force Atlas 2*¹⁰'s layout algorithm of Gephi. *Force Atlas 2* is a tool that helps in visualizing the categories and in creating their charts (i.e. figure 1). In this chart—the *recurrence field graph* produced by the *matrix of frequencies*—, the nodes, the bigger colored dots in figure 1, represent each one of the categories, their sizes represent the frequencies of each category, and their colors represent the corresponding groups of categories in which each node is embedded. The black dots, the smallest dots visible in the chart, represent the 171 JMTE papers that compose the empirical material analyzed. The second and third charts—the *network of co-occurrence graph* and the *network of filtered co-occurrence graph* produced by the *matrix of co-occurrence*—were generated by using *Force Atlas 2*'s layout algorithm and the *modularity*¹¹ measure. *Modularity* was used as a measurement for detecting 'communities of connected nodes'. Each community is located automatically through the algorithms of *Gephi* and is represented by using different colors. Nodes that are connected densely are considered to belong to the same community; their sizes show the entanglement of the categories. Weight edges represent the number of co-occurrences between categories. Finally, to analyze more in depth our empirical material, we used other measurements provided by *Gephi*, such as "centrality measures"—*closeness*¹² and *betweenness*¹³. These measures help in interpreting in a thorough manner the resulting graph.

A CRITICAL READING OF THE GRAPHS

The final step is drawn on the problematization of the analysis deployed, by opening a critical reading of the dominant narratives, within JMTE, regarding the mathematics teacher. This problematization seeks to unpack the truths and dominant narratives that constituted the circulating discourses about the good—or desired—mathematics teacher, which frame the ways of thinking, understanding, and conceiving the mathematics teacher.

UNPACKING THE TRUTHS ON THE GOOD MATHEMATICS TEACHER

¹⁰ *Force Atlas 2* "is a force directed layout: it simulates a physical system in order to spatialize a network. Nodes repulse each other like charged particles, while edges attract their nodes, like springs. These forces create a movement that converges to a balanced state. This final configuration is expected to help the interpretation of the data." (Jacomy, Venturini, Heymann, & Bastian, 2014, p. 2)

¹¹ "Modularity (community detection) is a measure of network structure. It was designed to measure the strength of division of a network into modules" (Ji, Machiraju, Ritter, & Yen, 2015, p. 1929).

¹² "The closeness centrality that is the inverse of farness, which in turn is the sum of distances to all other nodes" (Guzzo, Ferri, & Grifoni, 2014, p. 1802).

¹³ "The betweenness centrality quantifies the number of times a node acts as a bridge along the shortest path between two other nodes" (Guzzo et al., 2014, p. 1802).

The *recurrence field graph* (Figure 1) represents the frequency of categories, their distribution, and their relation with the empirical material. The color nodes sizes represent the *recurrence*. More specifically, it represents the frequency of the categories. The colors used in each category are: red for the category called *knowledge*, green for the category called *repertoire of techniques*, blue for the category called *personal attributes*, yellow for the category called *social context*, orange for the category called *deficit*, and light blue for the category called *effectiveness*. The small black dots represent the papers in which the analysis was deployed. These dots were not labeled since the focus of the study is not identifying who (re)produces or not (re)produces certain statements, rather the focus is on the intertwining of the discursive network. The nodes' position in the graph reveals the flow of recurrences according to the forces between nodes and edges.

The *recurrence field graph* traces the frequency and distribution of each category, by giving a broader vision on how discursive network is been entangled through JMTE articles to (re)produce certain discourse about the mathematics teacher. The discursive network that composes the mathematics teacher research has delineated a way of constituting the mathematics teacher and, at the same time, has delineated what is considered as valid to be enunciated under a certain regime of truths. The *recurrence field graph* draws attention on how discourses are shaped and (re)produced by research. As an initial approximation, it is possible to see that the statements are concentrated around the categories *mathematics teacher's knowledge* (red), *the repertoire of techniques for teaching* (green), *the effectiveness* (light blue), *the personal attributes* (blue), and *deficit* (orange).

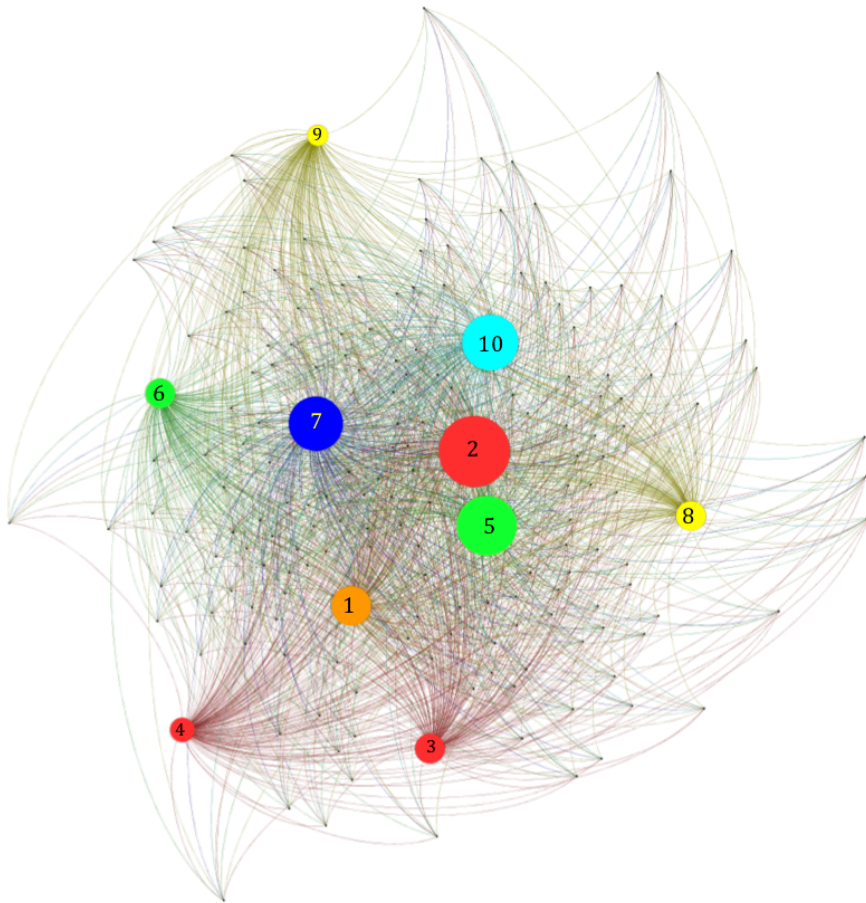


Figure 1: *The recurrence field graph*

- (1) Deficit
- (2) Mathematics Teacher's Knowledge
- (3) Mathematical Knowledge for Teaching
- (4) Pedagogical Content Knowledge
- (5) Repertoire of Techniques for Teaching
- (6) Repertoire of Administrative Techniques
- (7) Personal Attributes
- (8) Mathematics Teacher is Part of Social Context
- (9) Mathematics Teacher Respond to Context
- (10) Effectiveness

In mapping the *recurrence field*, we are able to unpack what truths have been (re)produced about the good—desired—mathematics teacher within the research on mathematics teachers. In the following sections, we are going to unfold these taken-for-granted truths.

A DESIRED MATHEMATICS TEACHER IS KNOWLEDGEABLE...

The knowledge in mathematics that mathematics teachers have and should have for their teaching practice “has received significant attention in mathematics education research” (JMTE, 2015, p. 101) , given that it “has been identified as an important factor that influences the outcomes of teacher practice” (JMTE 2014, p. 430). The need for improving or increasing mathematics teachers’ knowledge has become the center of initiatives to boost mathematics education (JMTE, 2011, p. 171), and to improve the quality of teachers. This is due to the dominant narratives about teachers’ mathematical knowledge, for example, that it is essential for effective instruction (JMTE, 2013, p. 211) for a successful classroom practice (JMTE 2014, p. 373), and for students achievement (JMTE, 2016, p. 371). “Much of the research on teachers’ knowledge in the past two decades has been framed by knowledge categories articulated by Shulman” (JMTE, 2015, p. 469). In this light, *Pedagogical Content Knowledge* (PCK) has been refined and specified to mathematics teaching, and shaping what Ball and Bass (2000) have called *Mathematical Knowledge for Teaching* (MKT). MKT comprises the mathematics used by teachers to achieve the tasks that are central to their practice (JMTE, 2015, pp. 467-488).

The focus on teacher’s knowledge “has become an important way to think about teachers and their work” (JMTE, 2013, p. 237). Within research, it is enunciated that a high quality mathematics teaching depends on teachers’ mathematical knowledge, their problem solving skills, and the pedagogical tools and techniques teachers possess for the teaching of school mathematics (JMTE, 2013, p. 451). Also, it is enunciated that the mathematics teacher has the responsibility of “honor[ing] the integrity of mathematics as scientific field of knowledge” (JMTE, 2012, p. 319). Moreover, it has been established that mathematics teacher practices improve by the acquisition of more mathematical knowledge. Therefore, *‘the more knowledge, the merrier and the better mathematics teacher’*.

...IS A MASTER OF A REPERTOIRE OF TECHNIQUES...

Mastering mathematics itself is not sufficient for a successful teaching. Teachers also need to master pedagogical strategies and methods, such as didactics. On the one hand, teachers need these strategies and methods for their teaching, for example, teachers should be able to consider students' thinking during their teaching (JMTE, 2016, pp. 433-456). Mathematics teacher's “[I]ack of teaching experience may be a factor accounting for lower mathematics achievement[...] Effective teachers are those who develop strong knowledge of teaching, content, and how their students learn” (JMTE, 2016, p. 8). Also, it has been recognized that the prospective teachers have limitations “in the flexibility of their mathematical thinking and tending to rely on standard algorithms” (JMTE2015, p. 368). On the other hand, teachers need these strategies and methods for navigating in classroom instruction and in the administrative level—in order to achieve successful teaching of mathematics.

“[Mathematics] teachers have at their disposal a wide variety of tasks to choose from when planning mathematical activities” (JMTE 2013, p. 286); they need to know how to choose the best tasks for their school context and reality and how to fit their repertoire of techniques. The repertoire of techniques that the teacher must arrange has been related to different students’ outcome and social aspects of instruction, given that teachers’ quality has been correlated with students’ performance (JMTE, 2016, pp. 7-32). A good repertoire of techniques promotes high level of students’ achievement (JMTE, 2012, pp. 453-479), as well as teachers’ own professional development (JMTE, 2014, pp. 85-100).

The practices of teaching acquire great significance when teachers engage in them collaboratively (JMTE, 2015, p. 234). Collaboration, teamwork and reflection are key elements in teachers’ professional development, since “[t]eachers collaborate and learn through cycles of enquiry into their practice, and this provides unique opportunities for researchers to investigate how teachers learn through the process of developing, adapting, mediating, and reflecting on lesson plans” (JMTE 2016, p. 245). “In fact, many of the most successful professional development settings for teachers occur in research settings that pair university researchers (teacher educators) with K-12 mathematics teachers” (JMTE, 2015, p. 247).

Teaching competence, and also the dilemma of how to measure set competence, has been on the educational agenda for more than a century (JMTE, 2012, p. 131). It is enunciated that increasing some aspects of teachers’ knowledge and practices may promote growth in other areas of teachers (JMTE, 2014, pp. 5-36). It is established that *the repertoire of techniques for teaching* and *the administrative techniques* help mathematics teachers in becoming effective and competitive. And so, teachers have to be in a constant process of improvement. This entails that mathematics teachers will never be good enough, and that they are always going to be able to improve practices, to have better results, and to become a better teacher. Consequently, the repertoire of techniques, as well as the knowledge of mathematics that teachers need to have, are in a ongoing process of reformulation. Mathematics and its teaching are always changing (JMTE, 2011, pp. 419-439), society is constantly requiring new techniques and knowledge that teachers need to put in operation for achieving good practices and the desired outcomes. Therefore, ‘*the mathematics teacher needs an updated repertoire of techniques*’, and that ‘*a good repertoire of techniques provides ways of acting needed for the teacher to face new demands and challenges*’.

...AND HAS PERSONAL ATTRIBUTES THAT ARE KEY FOR THEIR PRACTICE

Personal attributes are also relevant for achieving a good teacher’s practice. These personal attributes have been linked to the becoming of mathematics teachers as key factors that impact their teaching. For example, teachers’ behavior and beliefs influence their knowledge and practice, and their students (JMTE 2014, pp. 5–36).

Teachers' beliefs are relevant in their professional decision-making, such as how they address their mathematics teaching (JMTE, 2015, p. 300). Teachers reflect their beliefs in their classroom practices (JMTE 2014, p. 3). These practices are influenced by teachers' attitudes, beliefs, and dispositions (JMTE, 2015, p. 408). Also, instructional dialogues are shaped by various complex factors; one of these is teachers' personal assumptions about the ways students construct their knowledge (JMTE 2011, p. 6). And so, the teaching of mathematics has been defined as "the beliefs, knowledge, and dispositions that are actionable in the flow of instruction, and [...] growth in this area contributes to positive change in mathematics instruction" (JMTE, 2015, p. 447). Therefore: *'personal attributes have an impact on the becoming, as well as, on the ways of being an acting of the mathematics teacher'*.

TEACHERS EMBEDDED IN A SOCIAL CONTEXT...

Mathematics teachers "have a tough time in today's social and economic environment" (JMTE, 2012, p. 103), since the constant social and economic changes demand and challenge teachers with new requirements, either new knowledge, new responsibilities, or new techniques. These changes have conducted teachers and their becoming, development, and learning. Teacher's learning is understood as a sociocultural activity (JMTE, 2012, pp. 67-82). In this fashion, it is recognized that "the fact that PTI [Professional Teacher Identity] is responsive to social context implies participation in communities of practice" (JMTE, 2014, p. 370). This means that even if the previous statements mostly focus on characteristics of individual teachers, it is acknowledged that *teachers are immersed in a social context*, and also that they *have to respond to their context and reality*. It has been acknowledged that mathematics teachers are conditioned by their context and culture (JMTE, 2015, pp. 299-325). They must be aware of students' social, economic, and individual aspects to adjust their practices (JMTE, 2013, pp. 379-397), in order to favor a better teaching (JMTE, 2015). Mathematical knowledge is both an individual and a social construction, within which the individual and social dimensions of learning complement each other (JMTE, 2013, pp. 293-318). Mathematics teacher education "is a multifaceted phenomenon with links and connections to many other fields within and outside mathematics education" (JMTE, 2013, p. 489). Therefore: *'mathematics teachers have a social mission/responsibility'* and *'their practice is influenced by their context'*.

...ARE DEFICIENT...

The quality of mathematics teachers is continually questioned, and this is evident in arguments around the adequacy of knowledge and techniques that teachers should develop, should acquire, or should have. All these are deemed deficient with respect to the fulfillment of desired outcomes and achievements for teaching and students' learning. In other words, research has posed the existence of a gap between the

desired mathematics teacher and the mathematics teacher of flesh and bone. It has been argued that a mathematics teacher of flesh and bone does not necessarily have, firstly, a complete mastery of mathematical knowledge; for example, that the teacher does not have a dual conception of the complex number (JMTE, 2015, p. 328), or that there are few effective, early-childhood teachers of geometry (JMTE, 2011, p. 137). Hence, it is imperative for “teachers to learn the content they will be expected to teach at a deeper level as well as have an understanding of the connections between the content [of diverse levels]” (JMTE, 2015, p. 233). Secondly, a teacher also lacks a repertoire of adequate or updated techniques. Therefore the teacher needs to develop the skills and expertise needed for, for example, implementing decisions (JMTE, 2013, p. 142). “Improving teachers’ abilities to implement productive decisions will reduce the number of negative impacts on student learning” (JMTE, 2013, p. 141). An effective repertoire of techniques is related to a better teaching of mathematics, but these techniques need to be contently reshaped. Thirdly, a teacher may also have personal characteristics that fit with his/her work, for example, the teachers’ dispositions and motivation are not always the best, but should definitely be better. It is recognized that teachers need to improve their dispositions, since these contribute to conscious reflection on mathematical ideas (JMTE, 2014, p. 554). Moreover, “teachers’ motivation—particularly beliefs about what is important and what one is able to do in mathematics—accounts for the relationship between what teachers know and what they do in instruction” (JMTE, 2015, p. 482). Mathematics education research has been offered as a means for promoting improvement and overcoming deficits of mathematics teachers. Is in this light that research has been taken as a way of fixing mathematics teachers with the intention of fitting real teachers, of flesh and bone, into the desired mathematics teacher; a desired teacher that is in a constant process of change. Therefore: *‘the teacher is in deficit, and s/he has to be in a constant redesigned and improvement’*.

...AND ARE NOT EFFECTIVE

“[T]he question of what constitutes good or effective mathematics teaching is at the heart of educational research” (JMTE, 2015, p. 501). “Understanding what contributes to teaching effectiveness has for long attracted researchers’ interest, with different frameworks capturing teaching capacities proposed toward this end” (JMTE, 2015, p. 427). Students’ academic progress and achievement are affected by teachers’ effectiveness (JMTE 2011, p. 137). There are diverse understandings regarding the effective mathematics teacher. The configuration of ideas about effective teachers depends largely on how—nationally or internationally—good education is conceptualized, as well as, the expectations of the educational system. In other words, teachers’ effectiveness change according to what society will expect that students have within their repertoire of knowledge, skills, and techniques.

The mathematics teacher’s effectiveness has been related with diverse aspects of teachers. For example, regarding their knowledge, “[t]here is growing evidence to

suggest that teachers with higher MKT tend to be more effective teachers” (JMTE 2013, p. 214), or regarding the teacher education, “[t]he main purpose of using technology in teacher education is to improve teacher effectiveness and student learning”(JMTE, 2012, p. 330). It has been (re)produced by research that the purpose of all mathematics teachers should be to become an effective teacher. Therefore: *‘the effectiveness of teacher ensures to successful of the teacher, as well as of the student and the system’*.

SO, WHAT ARE THE CIRCULATING TRUTHS WITHIN RESEARCH ABOUT THE DESIRED MATHEMATICS TEACHER?

According to research—JMTE articles—, the desired mathematics teacher is produced by the amalgamation of a wide range of features. The desired mathematics teacher must possess a vast repertoire of knowledge and techniques for his/her practice, with the aim of successfully attending to his/her context and ensuring high-levels of quality teaching. He/she also must have personal attributes that guarantee the best practices, achievements and outstanding ways of being and acting. However, by stating what is desirable, within research there exist expressions regarding how insufficient mathematics teachers are. The mathematics teacher is recognized to have clear deficiencies and needs to be reconfigured—fixed. Deficiencies in terms of their lack of effectiveness and lack of competence. Therefore, a effective mathematics teacher relies on an appropriate mathematical knowledge, repertoire of techniques and personal attributes, which, at the same time, delivers high level of students’ achievement.

ANALYZING THE RELATIONSHIPS BETWEEN THE CATEGORIES

By mapping the relationship between the categories that constituted the recurrence field, it is possible to draw the network of co-occurrence graph (figure 2). This graph sheds light on the narratives that circulate within research and the flow of their recurrences.

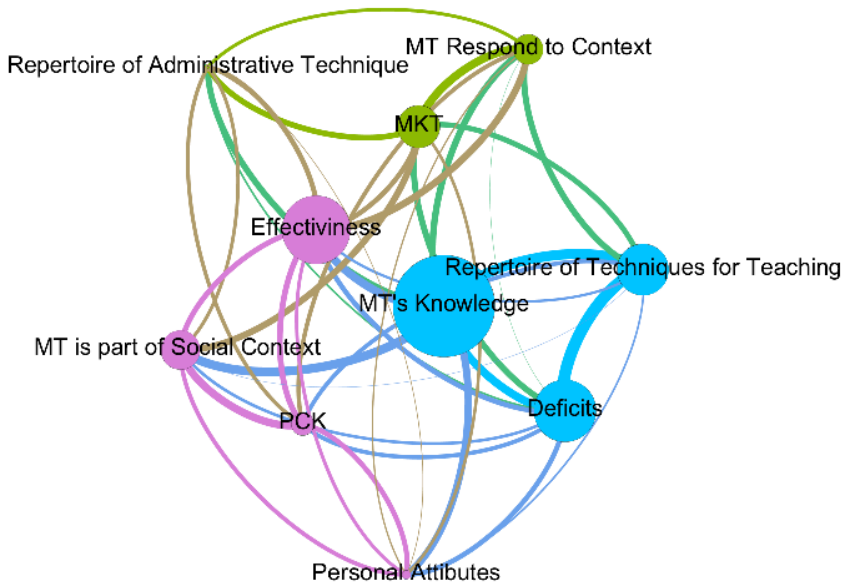


Figure 2: The network of co-occurrence graph

In the network of co-occurrence graph¹⁴, the node size represents the frequency of co-occurrence of each category, and the weight edge represents the frequency of co-occurrence between categories. By using the modularity measure¹⁵, three communities are detected: (a) MKT, MT Respond to Context, and Repertoire of Administrative Techniques, (b) PCK, MT is part of Social Context, Personal Attributes, and Effectiveness, and (c) MT's Knowledge, Repertoire of Techniques for Teaching, and Deficits. These communities express the dominant narratives regarding the mathematics teacher that are entangled in the research. The categories with a higher value¹⁶, according to the Betweenness Centrality, are Deficits and Effectiveness. Both of them act as junctions for enabling the communication between network's categories (Freeman, 1977). And according to the Closeness Centrality, all categories have similar conditions of influencing the entire network, given that the paths between nodes in the network are similar and short¹⁷. Which

¹⁴ The diameter of network is 2, namely, the distance between any pair of nodes is at the most 2 edges, for example, in order to move from *Mathematics Teacher is part of Social Context* to *MT Respond to Context*, it is needed 2 edges and 1 node in order to connect them. The density of network is 0.889, the graph represents a close network, in other words, the connectivity of network is high. The average path length of network is 1.111, the connection between is efficient.

¹⁵ The modularity measure clusters the nodes that are more densely connected to each other.

¹⁶ Deficits and Effectiveness with a value of 0.678

¹⁷ The values of categories are between 0.818 and 1

means that the capacity of accessing or articulating others categories from a particular category is high.

In order to identify the dominant narratives, *the network of co-occurrence* is filtered; this process implies the selection of the stronger categories regarding their co-occurrences. This filtering enables to obtain *the network of co-occurrence filtered graph* (figure 3).

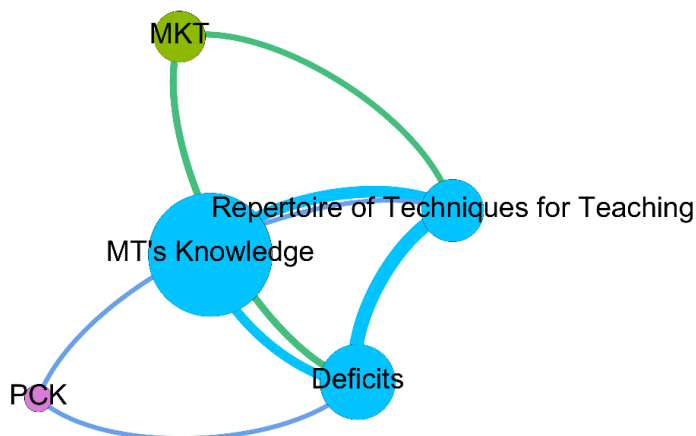


Figure 3. The network of co-occurrence filtered

The network embedded in this graph (figure 3) shows how dominant narratives about the mathematics teacher are intertwined. For example, what has been (re)produced within the community (a) is connected with the other two communities (b) and (c) through the co-occurrences produced by *Deficit* and *Repertoire of Techniques for Teaching*. More in depth, one of the dominant narratives being (re)produced by the research about the mathematics teacher entangles *MT's Knowledge*, *Repertoire of Techniques for Teaching*, and *Deficits*. This dominant narrative embodies taken-for-granted truths about what mathematics teachers have or do not have, or lack and do not lack to be considered successful mathematics teachers. In other words, *knowledge*, mainly MT's knowledge, and *Techniques for Teaching* are taken as cornerstones of this narrative, as well as the existing gap between mathematics teachers and the desired mathematics teacher: their *Deficits*. These circulating truths shape our ways of thinking and understanding the mathematics teacher, as well as a corpus of accepted forms of knowledge that constitute power, in terms of Foucault, by (re)producing discursive networks where the desired teacher is build. An example of this is shown in Montecino and Valero (2017): The mathematics teacher is condemned to be incomplete, even more, the teacher becomes a subject *in debt*; someone who needs to reformulate constantly his/her practices, knowledge, beliefs, among others, according to new requirements,

demands, and urgencies of society and the market. However, due to the fast changes of society, the mathematics teachers will never be enough.

The *Deficits* of the mathematics teacher emerge from a constant comparison between the mathematics teacher and the ever-changing image of the desired teacher. These comparisons have established ways of measuring diverse aspects of mathematics teachers. Such measurements are built “on the hierarchical organization of attributes. A low measurement inevitably positions an individual in a deficit zone” (Halai, Muzaffar, & Valero, 2016). Through *deficit*, a particular mathematics teacher is fabricated; teacher’s conduct is governed by the productive side of power. From the analysis, it seems that the value of mathematics teachers is constituted according to their capacity of adapting to new demands and requirements. This adaptation capacity requires a continuous process of (re)training to update their repertoire of *knowledge and techniques*, in order to overcome any possible *Deficit*.

Moreover, following Pais’ (2013) argument, it is possible to see that the constitution of the use-value of the mathematics teacher is disavowing its value as part of a political and economic structure. Given that taken-for-granted truths are not configured in terms “of the value it has within the complex universe of socioeconomic relations” (Pais, 2013, p. 16). Even more, the dominant narratives closer to this configuration are those that have been formulated around the relevance of mathematics teachers for society. However, these dominant narratives are not drawn from their socioeconomic relations, rather from *Knowledge and Techniques for Teaching* that mathematics teacher have or must have, as well as the teachers’ engagement with overcoming any *Deficits*.

CONCLUSION

By analyzing the discursive network about the mathematics teacher (re)produced by research, in specific the research published by JMTE, this paper mapped the convergence and the entanglement of truths and narratives regarding the desired mathematics teacher. The research about the mathematics teacher has played a key role in the constitution of conditions, in which rationalities and power/knowledge regimes shape the (re)fabrication of a desired teacher. This puts in operation ways of understanding, arguing, and thinking, as well as valid ways of knowing and researching, in order to legitimizing a kind of mathematics teachers based on the scientific knowledge. Within such regimes of knowledge, it is established “who does and who does not have the intellectual authority to decide issues, how information should be gathered about who and by who, and the like” (Bevir, 1999, p. 66). Regimes of power shape “what counts as a meaningful utterance, what topics are to be investigated, how facts are to be produced, and the like[...] [A]ll regimes of power are constituted by discursive formations.” (Bevir, 1999, p. 66).

The research about mathematics teacher has constituted the teacher as an object of study and of knowledge. The regimes of power (re)produce truths and narratives that conduct mathematics teachers' ways of being and acting in relation to a desired mathematics teacher, who is constantly changing. In other words, the fabrication of a desired mathematics teacher could be understood as a technique of government, putting in operation a discursive network about what the teacher needs for being considering a good teacher. As Andrade–Molina (2017) asserts,

Technologies [of government] conduct individuals to change, structure, and constitute themselves as subjects, by enunciating the practices of the self [...] that pursue the fabrication of the desired [subject]. In a Foucaultian sense, power enables the subject to embrace these models and act with them productively. (p. 25)

The circulating discourses on the mathematics teacher, especially discourses that highlight the importance of the teacher for society, contribute to shaping the teacher as a political and economic subject that must respond to necessities of the system. The more mathematical knowledge, the more important teachers will be for society. Yet, the political and economic conditions of mathematics teachers' work seem not to be an issue of interest or concern for researchers. Even more, it seems that mathematics teacher research disavows or blurs the political and economic of the teacher, what can be seen in the key elements around which the (re)production of certain narratives and their truths are articulated. Although in circulating discourses, teachers are “embedded in a social context”, the significance of the context for notions of professionalism and of what characterizes a good teacher are not problematized or questioned, in other words, these are not significant part of the discourses that research builds about the mathematics teacher.

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Montecino, A. (Submitted). The professional mathematics teacher: fabricating and governing of teacher becoming. *Educação Unisinos*.

The Professional Mathematics Teacher: Fabricating And Governing Of Teacher Becoming

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ABSTRACT

This paper aims at unpacking the becoming of the mathematics teacher as professional immerse in Chilean society, by mapping the changes that have taken within his/her fabrication and governing. A Foucault-inspired history of the present is deployed, as an analytical strategy, to problematize how the discursive assemblage of social development and school mathematics produces a particular mathematics teacher—an autonomous professional that has to engage in continuous training and has to be a good decision-maker, framing within political and economic agenda. Ways of conceiving and understand the mathematics teacher are (re)producing a discursive network, which operates as a technology of government for the fabrication of the desired mathematics teacher.

Keywords: becoming, history of the present, mathematics teacher, Foucault

RESUMO

Este artigo tem como objetivo desembrulhar o devir do professor de matemática como profissional imerso na sociedade chilena, mapeando os câmbios que ocorreram dentro de sua fabricação e governança. Uma historização do presente, inspirada no trabalho de Foucault, é usada como uma estratégia analítica para problematizar como a montagem discursiva do desenvolvimento social e da matemática escolar produz um professor particular de matemática—um profissional autônomo que deve se empenhar em treinamento contínuo e que deve ser um bom tomador de decisões, dentro da agenda política e econômica. As formas de conceber e compreender o professor de matemática estão (re)produzindo uma rede discursiva, que funciona como uma tecnologia de governo para a fabricação do professor de matemática desejado

Palavras-chave: Devir, historização do presente, professor de matemática, Foucault

INTRODUCTION

By navigating within discourses about the mathematics teacher is possible to identify a large number of statements concerning the relevance of mathematics teachers (see, Huang & Shimizu, 2016; MINEDUC, 2012; OECD, 2016a).

Mathematics teacher's quality has been linked with the development of a better educational system and increasing educational quality (Luschei & Chudgar, 2015; OECD, 2016b); with more and better opportunities for students (UNESCO, 2007); with a more fair society (OECD, 2014); and with the improvement of social conditions (OECD, 2005). At the same time, that these statements are (re)produced, it has been asserted that the mathematics teacher does not have the necessary competencies, knowledge, and qualities for becoming an effective and competitive teacher. In other words, the mathematics teacher is recognized to be deficient. According to the Chilean teachers' assessments, it is stated that initial teacher training does not achieve the required quality standards. In 2011, a newspaper, called "La Tercera", published an article titled "Pedagogy graduates only know 33% of mathematics from the first four years of schooling". Here is emphasized that Chile obtained the poorest performance amongst 17 countries that participated in the Teacher Education and Development Study in Mathematics (TEDS-M). From this study, Chilean teachers know, at the most, 23% of subdomain of geometry and measurement, 29% of subdomain of algebra and functions, 31% of subdomain of data and chance, and 33% of subdomain of number and operations (La Tercera, 2011). In 2013, another newspaper called "El Mercurio" published an article titled "Pedagogy graduates assessment: 60% of teachers don't know the subject they teach", in which is shown that 55% of high school mathematics teachers assessed through *INICIA test*¹⁸ have an insufficient level of pedagogical and disciplinary knowledge (El Mercurio, 2013). This duality in circulating discourses embodies a narrative of exaltation and degradation, in which truths, knowledge/power relationships, and ways of thinking and understanding the mathematics teacher are entangled for fabricating and governing the mathematics teacher.

However, the fabrication and government of the mathematics teacher has not a natural and linear development, rather has a multiplicity of continuities and discontinuities. By mapping the becoming of the mathematics teacher as professional through different historical trajectories, it is possible to make visible the conditions that enable to think, understand and conceive the teacher the way we currently do: a teacher subjected to market rationality. The production of a particular mathematics teacher is problematized from a discursive assemblage. In this inquiry, the mathematics teacher is understood as a discursive formation that is constantly changing. As discussed elsewhere (Montecino & Valero, 2017); Montecino (2017), this inquiry refers to the mathematics teacher not alluding to a particular person, rather to a the desired mathematics teacher that circulates within dominant discourses. The desired mathematics teacher is an unreachable teacher even for those considered good teaches. The desired teacher can be named different ways—

¹⁸ In the Ministry of Education of Chile (MINEDUC) website states that the *INICIA test* is a diagnostic and formative assessment for graduates (or prospective teachers) of the teaching careers. This assessment focuses on pedagogical and disciplinary knowledge, being part of initiatives of the MINEDUC for the improvement of initial teacher training (see <https://www.ayudamineduc.cl/ficha/programa-inicia-5>)

the expert, effective or professional teacher—, nevertheless, these “are not teachers who exist but fabrications that research calculates and measures to actualize the desired model of the teacher” (Martins, Popkewitz, & Yanmey, 2015, p. 12).

ANALYTICAL STRATEGY

By problematizing the becoming of the mathematics teacher, his/her government, and fabrication, it is sought to contribute to the studies on the mathematics teacher by positioning the mathematics teacher within the social, political, and economic machinery. This problematization is conducted through a Foucault-inspired *historizing of the present* (Foucault, 1991): aiming at “seeing the present through different historical trajectories that make possible the objects of thought and actions” (Pereyra & Franklin, 2014, p. 10). The circulating discourses, truths, and knowledge about the mathematics teacher are thought “within a grid of historical practices that makes the object of research possible to ‘see’ and act on” (Popkewitz, 2012). According to Foucauldian approach, history is not understood from a linearity, a cause–effect relationship of facts and events, but the history should be used “as a means of critical engagement with the present” (Garland, 2014, p. 367).

Consequently, the history of the present is a strategy to make “problematic the stories we are given and those we tell” (Popkewitz & Brennan, 1998, p. 27), in this case, the stories about the mathematics teacher, by considering that “the past is intricately woven in constituting the present” (Popkewitz, 2013, p. 440). This inquiry is focusing on the constitution of institutions for teacher training in Chile; the establishment of ideas—that circulate or have circulated—, such as professional training, permanent training and the trained mathematics teacher; and finally, the establishment of a market for teacher (re)training, in order to trouble the fabrication of the mathematics teacher as a professional, who has to be in a continuous training and becoming a good decision–maker.

The empirical materials analyzed are publications released by Chilean government and Chilean Ministry of Education (MINEDUC) from late 19th century. Materials such as draft laws (e.g. MINEDUC, 2016), national reports (e.g. Longo, 1993; Schiefelbein, 1976), and curricular programs for teacher training (e.g. Mellafe, 1988; MINEDUC, 2012). Also, studies about Chilean teachers (e.g. Cox & Gysling, 1990; Gutiérrez, 2008) and documents that refer to the constitution of institutions for teacher training (e.g. Letelier, 1940; Nuñez, 1883). Although, the focus is not on who wrote these documents, rather on the constitution of a discursive network that shapes what could be said and thought about the mathematics teacher. Therefore, this article is not seeking to make a judgment on the authors or the institutions that produced such documents.

FROM THE TECHNICAL TEACHER TOWARDS THE PROFESSIONAL TEACHER

In the middle of 19th century in Chile, there was an interest in training qualified professionals for favoring the development of commerce and industries, in order to achieve the social progress and economic growth that was aspired. “Progress is understood as a consequence of the development of sciences and a suitable national system of education, ideas that were exposed by Bello¹⁹ on several occasions”²⁰ (Hernández, 1986, p. 135). Science has been historically understood as a secure means for achieving progress, which implicated to (re)shape Chilean education, since it was recognized that the real power of subjects resides in the head, and not in their arms (Nuñez, 1883). This configures a narrative in which social development will no longer depend on peoples’ raw force, rather on their intellectual force—a qualified professional that leaves the farms for being part of the industries. Creating suitable citizens through education was part of the foundation of diverse countries, during the late 18th century and early 19th century, developing educational system and curriculum for fabricating of citizen (Tröhler, Popkewitz, & Labaree, 2011).

In this fashion, the quality of the educational system and teachers are being called into question from their poor outcomes. In 1856, the Society of Primary Instruction was founded. This Society aimed at increasing the number of schools and the improvement of the teaching quality, for ridding people from ignorance, as well as lifting them out of poverty (Velásquez, 1873). It is acknowledged that the quality of the educational system and teachers are central for ensuring the training of a qualified subject that favor to achieve social and economic progress.

As countries began to establish national school systems, they found that they needed a larger supply of qualified teachers who had received a professional education. [...] And demands for better qualified elementary school teachers led countries to upgrade the institutions in which they were prepared from secondary to higher education status. (Kilpatrick, 1992, p. 5)

The constitution of a formal training for teachers was considered vital for improving the quality of the educational system and teachers. Letelier (1940) asserts that teachers’ quality leaves much to be desired, as well as the quality of candidates to be teachers, a problem that comes from the very beginning of Chilean school system. Teachers need to be trained since they are the most effective agents for achieving Chilean aspirations, such as, to elevate the moral and social conditions of people, to

¹⁹ Andres Bello is considered as one of the greatest humanist of Ibero–America, in 1829 was appointed as Chile’s Minister of Finance, in 1932 form part of board of education, which should propose plans and programs of study for all Chilean schools, 1837 was elected Senator, 1840 Bello and Egaña were designated for the elaboration of Civil Code, 1843 to 1865 was Rector of University of Chile, which was founded at the end of 1842, from the search of the modern national state of ordering the society according to the reason and science, idea valid for the National Institute, in which are trained the first professionals (Gutiérrez & Gutiérrez, 2000)

²⁰ All quotations are translated from Spanish to English by the author.

improve lifestyles, and to increase the production levels (Nuñez, 1883). In the search of improvement of the teacher and of a successful educational system, it was considered that vocational training was not enough for teaching; rather scientific and academic support was needed. Letelier (1940) asserted that is absurd to believe that inspiration and vocation are enough for being a teacher; teachers needed academic and scientific preparation, and, thus, understanding teachers not as technical workers, but as trained professional.

Before the foundation of institutions aiming at teachers' training; teachers and their educational job were structured on vocational attitudes and not on scientific knowledge. Teachers only needed to feel the "called for social service", a called that at some point was considered a "called from the divine". The ones who had the conditions for teaching became "qualified technicians" that only repeated, over and over, the lesson from a manual. "The manual! It was the beginning and end of the teaching" (Letelier, 1940, p. 24). The demand of more teachers, either for policies of expansion of the educational system in Chile or the lack of people who can teach (see Velásquez, 1873), led to people without the training and enough knowledge to take the position of teachers (Letelier, 1940); Gutiérrez (2008) asserted that before the foundation of the Pedagogical Institute—in 1889—, mathematics teachers of high school were lawyers, doctors, engineers, military retirees, and fiscal employees, but few of them had the engagement and the knowledge for teaching. But, this demanded—traced by the end of the 19th century—for a professional mathematics teacher with the knowledge and scientific support for teaching. Regarding the teaching of mathematics, in this period, it was enunciated that the mathematics was essential for the development of children's intellect and for disciplining their mental faculties (Nuñez, 1883), which can be reflected in the preface of the book titled 'The Elements of Geometry'

[...]the learning of the science is not only a mean of acquiring useful knowledge but the development of intelligence through the observation and analysis (Basterrica, 1877, p. 5).

THE MATHEMATICS TEACHER AS AN AUTONOMOUS PROFESSIONAL...

The more enlightened countries of Europe, such as Switzerland, France, Austria and Germany, have acknowledged that a good education needs to have good teachers, and for having good teachers, it is essential to train them in specialized institutions (Letelier, 1940). Over the 18th and 19th century, in diverse countries, new institutions of higher education were established to prepare teachers, which had as the main focus the practical preparation in how to teach (Kilpatrick, 1992). The establishing of a formal teacher education in Chile started in 1842, with the first Normal School, and the first Normal School for women in 1854 (Avalos, 2003; Cox & Gysling, 1990; Nuñez, 1883), which were based on the successful experiences of teacher training and implementation of educational system of European and American Countries (Nuñez, 1883)—in the 1760s. In various European countries,

“[t]he first initiatives by governments for teacher education were undertaken for elementary schools, establishing normal schools or seminaries” (Smid, 2014, p. 579). In particular, Chile recognized the effectiveness of the German model (see Nuñez, 1883), which promoted teacher training based on scientific knowledge, providing teachers with an academic support and training for teaching. Normal Schools were established on the German model.

There is little doubt that at least since the end of the Second World War, education policy and curricular developments have been determined fundamentally by international trends, supranational influences, and demands for global progress. (Tröhler & Lenz, 2015, p. 6)

Subsequently, in 1889 is founded the Pedagogical Institute²¹²² (Letelier, 1940), with great German influence (Avalos, 2003; Gutiérrez, 2008), here was created the career of the high-school mathematics teacher. In 1890 the Pedagogical Institute was part of the University of Chile. Gutiérrez (2008) stated that the Pedagogical Institute was established with the aim of introducing and developing pedagogy in Chile. To provide scientific foundations to teachers and a high level training were the main arguments for the creation of this institute. Internationally, “the education of future mathematics teachers became an object of concern[...] Mathematics teacher became a profession one could enter only by following a prescribed programme and by acquiring the necessary diplomas.” (Smid, 2014, p. 579). According to Letelier (1940), the need for constituting the Pedagogical Institute emerged from two main causes, causes that are also valid for the establishment of Normal Schools: (a) teaching was an exclusive responsibility of the Church, something that has changed in last years ²³; (b) a specific training for becoming teacher was not necessary because teaching was reduced to the mechanical labor of giving and receiving lessons, something that was sought to be changed by the establishment of teacher training institutions. At the beginning, German teachers were hired in Normal

²¹ The Pedagogical Institute laid the foundations for the development of mathematics in Chile, as a discipline autonomous, beyond of its teaching as ‘useful’ science, which was the goal of mathematics education in the 19th century (Gutiérrez, 2008). Previous to Normal Schools and Pedagogical Institute, Nuñez (1883) stated that the mathematics had been reduced to mechanical techniques to solve problems. Also, Gutiérrez and Gutiérrez (2000) affirmed that the mathematics as ‘useful’ science is constituted as a program of State for achieving the progress, responding to aspirations of who are part of the enlightened society of Chile, which believed that the teaching of science is the only mean of growing.

²² The mathematics teacher training in the Pedagogical Institute was comprised by: cultural and scientific training, general pedagogical training, mathematical training, and mathematical pedagogical training and practice of teaching (Gutiérrez, 2008).

²³ “The French Revolution ended the dominance of the churches in educational affairs. Later, states accepted responsibility for what we call now secondary education (particularly in France and Prussia). Mathematics became an important part of that education. As a consequence, the education of future mathematics teachers became an object of concern for those states, which started to issue decrees and laws to ensure the quality of the mathematics teachers at the new, state-regulated schools for secondary education.” (Smid, 2014, p. 579)

Schools and in the Pedagogical Institute, for example, *Poenisch* and *Tafelmacher*²⁴ (see Gutiérrez & Gutiérrez, 2014). They helped in the drawing of mathematics teacher training programs and in the teaching of mathematics in diverse levels. Letelier (1940) asserted, “we have to resort to German teachers if we want to give to prospective teachers the best pedagogical education” (46–47).

The formal training of teachers shapes an autonomous teacher, a teacher equipped with tools, knowledge and teaching methods that enable him/her to manage the diverse aspects of the teaching and learning of mathematics beyond only repeating what is said in a text or manual. This movement enabled to leave the teaching of the mathematics as a mere application behind, since the teacher was ought to teach mathematics not as a set of propositions and rules that respond to certain human activities, such as, the trade or the industry, rather as a system of ideas and valid and useful knowledge for everyday life (Gutiérrez & Gutiérrez, 2014). In other words, the educated teacher became an autonomous agent of teaching, an expert in possession of the necessary knowledge and authority for teaching; someone “who does not only has the ability to make independent pedagogical decisions and judgments, but who also displays personal and moral commitment” (Sitomaniemi-San, 2015, p. 54), and is able of fostering his/her field (Poblete, 1964).

...THAT HAS TO BE IN CONTINUOUS TRAINING...

“Something that can not be improvised in education is the teacher” (Letelier, 1940, p. 21). Around 1960, almost all countries had a lack of teachers (Grube, 2015). Even more, of quality teachers—there is a direct relation between teachers’ quality and the level of educational system quality (Letelier, 1940). Diverse social changes and new requirements have revealed that initial training is not enough for ensuring a quality teacher and quality education. The teachers who needed training based on scientific knowledge, now need to be immerse in a continuous training process. The autonomous teacher has to become a lifelong learner, a subject that never stops learning, a subject that is embedded in a continuous training process, in which he/she will be always in a becoming process. In the reforms deployed in the government of 1964 and 1970, it introduced conceptually and institutionally the notion of continuous training, which considered an initial and continual education (Avalos, 2003). Schiefelbein (1976) stated that teacher as professional must develop continuous learning, leaving out the idea that the teacher is a technical and operational performer. Also, PIIE (1984) enunciates that continuous training help teachers to modify and improve their practices, as well as to perceive themselves as professionals of education. At the end of the 20th century, along with the establishment of idea of continuous training, Chile began working in the

²⁴ Both are who teach the mathematics and the new teaching methods based on the German pedagogy in the Pedagogical Institute, and who supervise the teaching practices. Also, they published ‘The Elements of Mathematics’, a text with 6 volumes dedicated for the studying of mathematics in Chile (Gutiérrez, 2008)

strengthening of the teaching profession as part of the educational reform, which is configures teachers' professional development as one of its priority. For example, in 1990 MINEDUC implemented the initiatives '900 schools' program' (see Gutman, 1994; MINEDUC, 2001) where one of the lines of action were teacher's professional development. Public policies about retraining and improvement of teachers have had the focus on the deployment of diverse initiatives of teachers' professional development (Bruner & Cox, 1993).

As years pass, it has been established the demand—and need—of more and better mathematics teachers, new schools are being opened and more children are accessing to education. Also, several social changes are demanding subjects with new knowledge and skills. In order to supply such demand, other institutions²⁵ started to be responsible for mathematics teachers' training, according to the model of Pedagogical Institute—which formed part of the University of Chile. The model of Pedagogical Institute, also, was a model exported to certain Latin American countries, for example, Venezuela at 1936 (Gutiérrez, 2008).

...AND BECOMING A GOOD DECISION-MAKER

Due to the social demands and changes, the teacher needs to invest in upgrades—retraining programs in order to favor his/her professional development. In other words, to invest in self-capitalization and human capital for not become *obsolete* (see Montecino, 2018). The (re)training teacher are configured as a products, which is offered by diverse agencies and that must be consumed by teachers. There is a close relationship between the professional development and the retraining of the teacher with the financial sector, either by inversions and debts that teachers—e.g. currently, a master degree in mathematics education in Chile is around 8.000 dollars—and other social agents—e.g. in 1996 the Chilean government makes available 25 million of dollars for initial teacher education—incurred or by monetary benefits that this can generate—Jofré (1988)²⁶ stated that is profitable for the society that citizens become educated, spite of that the state invests in government subsidies for poorer students. It has configured diverse programs for (re)training of the teachers, constituting a market traced by programs fabricated and

²⁵ In 1925 the Pontifical Catholic University started with this labor with the creation of with the faculty of philosophy and education science. Later, the University of Concepción, the Catholic University of Valparaíso, the Austral University, the University of North and the University of Santiago started with the mathematics teachers' training.

²⁶ Gerardo Jofré, Ministry of Finance between 1985-1989. His written is a testimony of how Chile integrated the ideas of Friedman, with a component of Catholic conservatism (Schneider, 1997).

managed by governmental and private agencies—such as CPEIP²⁷, universities and specialist entities.

The most important Chilean challenges of the 20th century were the expansion of coverage in education²⁸ and its quality. A measure for facing these challenges was the privatization²⁹ of the educational system—during the military regime (1973 to 1990) —, since, Chilean State did not have the necessary resources for reaching the expansion of educational system (Bruner & Cox, 1993). During this regime, teachers lose their condition of public employees. Moreover, the teacher' salaries were determined for every employer (public or private), which were reduced to the 50%. Shaping market logic of who—schools and universities—has the most money is who can hire the best teachers. With the privatization of the educational system, the teacher has the free choice of selecting where study his/her initial and continuous training, where working and in what invest. The teacher and the teacher (re)training are reformulated as a consumer good or merchandise.

Such professional teacher, autonomous that is in a continuous training, needs to become a decision-maker. Teachers have the right and responsibility of their professional retraining (Ministerio de Educación Pública, 1992), as professional, teachers must be capable of managing their professional development of the best way. The effectiveness and competitiveness of teachers are in function of their capacity of making good decisions, entangling the interests personal with interests collective and social with the aim of getting the most benefit. The mathematic teachers as decision-maker has been less to do with mathematics and its development, management or teaching but more about the production of ways of distinctions and differentiation, due to competence logic.

FABRICATING AND GOVERNING OF THE MATHEMATICS TEACHER

The teacher “brings progress to society through the social administration of the child” (Popkewitz, 1998, p. 2) and the fabrication of qualified subjects by new times. The contemporary societies depend on knowledge and skills of their population, in other words, population's human capital (Brunner & Elacqua, 2003),

²⁷ This center certifies “courses or programs that are imparted in public or private institutions —nationals or internationals— with the aim of ensuring the quality and relevance for the professional development of teacher” (MINEDUC, 2016, p. 4)

²⁸ In Chile were configured policies for setting of the compulsory education, in 1965 is set the compulsory education for primary education (eight years of minimum schooling), but, in 1920 was established four years of minimum schooling and in 1926 was increased schooling from four to six years. In 2003 is set the compulsory education for high school (twelve years of minimum schooling). And in 2013 is set the compulsory education for kindergarten education.

²⁹ For example, in 1982 the MINEDUC enabled the establishment of private institutions of higher education, such as universities and institutes.

for achieving the social well-being and growth. All social phenomena is regarded “as resulting from the economic calculations and investment decisions of individual actors” (Shaviro, 2011, p. 76)

The mathematics teacher as professional is framed under the idea of cost-benefit; the market is delineating forces, dispositions and discourses, where the mathematics teacher is shaped. In this fashion, the teacher must be able to calculate the risks and invest all his/her decisions. The mathematic teacher is governed for searching to satisfy the social need of better mathematics teachers, in which the teacher has new levels of ‘freedom’, the consumerism. It seems that teacher has control over their life and professional development, but rather, social interests, demands and changes drawn the teacher. The professional teacher becomes a *homo economicus*. “Homo economicus is an entrepreneur, an entrepreneur of himself [...], being for himself his own capital, being for himself his own producer, being for himself the source of earnings” (Foucault, 2010, p. 226).

The professional mathematics teacher is fabricated as ‘entrepreneur’, who is self-regulated and self-control for becoming a productive and competent teacher, a trained, autonomous, continuous learner and decision-maker teacher that pursues his/her interest. The teacher as ‘entrepreneur’ does not offer his/her workforce by a salary; rather hi/her capitalize a capital, in other words, a set of others elements of their work, practices and education. “Salary or wages become the revenue that is earned on an initial investment, an investment in one’s skills or abilities.” (Read, 2009, p. 28). But, is the fabrication of this kind of mathematics teacher the desired?

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CHAPTER 5. THE CONDUCTING OF THE MATHEMATICS TEACHER'S CONDUCT

Maybe the most certain of all philosophical problems is the problem of the present time, and of what we are, in this very moment. (Foucault, 1994a, p. 336)

This movement is focused to rethink the fabrication of the mathematics teacher within a social, political, and economic machinery. A quasi-Darwinism is drawn as a model that conducts the becoming of the mathematics teacher (paper 4), in which the constitution of an outdated mathematics teacher is a product of a strategy framed under planned obsolescence (paper 5). The problematization of the fabrication of the mathematics teacher is aimed at denaturalize the circulating discourses, truths, power/knowledge relationships and rationalities that compose the grid wherein the teacher is thought.

Currently, the mathematics teacher is at constant risk of becoming obsolete. It seems that he/she is condemned to be constantly deficient and in a process of improvement that never ends. The teacher is framed under the principles of the survival of the *fittest*, through a continuous process of improving (*evolving*) and competing. Moreover, the mathematics teacher is constituted as an *entrepreneur* of him/herself. He/she must be able to calculate costs and benefits of all decisions that he/she will make, either regarding to his/her professional development or to what he/she consumes. The planned obsolescence's power lies in its capacity of characterizing the desired mathematics teacher, excluding and rejecting what is considered to be outdated, non-effective, and non-productive. As Foucault (1980) asserted "[t]here is no power that is exercised without a series of aims and objectives" (p. 98).

Permanent training has been historically embedded within discourses of the desirable, acceptable, and normal, as a new technique of governing. The enunciation of what the mathematics teacher needs and should improve expresses double gesture of hope and fear. The hope that the mathematics teacher will become a competitive and effective teacher, who embodies ways of thinking and acting, and who promote a dominant rationality. But, at the same time, the fear that this competitive and effective teacher will not be achieved. The constant search for improving mathematics teacher involves to continually produce a new teacher, constituting a paradox. When society has enunciated that the mathematics teacher has to improve, it means that the current mathematics teacher has to become more effective and more competent, but, at the same time, it means that the current teacher has become

worse than he/she is. The mathematics teacher will not be better without becoming worse and vice versa.

According to a quasi-Darwinist view, consumption is the way for the mathematics teacher not to become obsolete, the means of becoming the *fittest*, and becoming-other. “The actual is not what we are but, rather, what we become, what we are in the process of becoming —that is to say, the Other, our becoming-other.” (Deleuze & Guattari, 1994, p. 112).

Montecino, A. (2017). The mathematics teacher's quasi-Darwinism. Problematizing the mathematics education research. In G. G. T. Dooley (Ed.), *Proceedings of the 10th Congress of the European Society for Research in Mathematics Education* (pp. 1521-1528). Dublin, Ireland: DCU Institute of Education and ERME.

The mathematics teacher's quasi-Darwinism: Problematizing mathematics education research

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This paper discusses the configuration of a quasi-Darwinian view of mathematics teachers, where the survival of the fittest is the cornerstone of a network of practices and discourses. It aims to contribute to the problematization of how mathematics education research and its discourses have effects of power in the fabrication of mathematics teachers' subjectivities, by unpacking naturalized truths of research – truths regarding a productive and successful mathematics teacher. It deploys a Foucault-inspired discourse analysis, and it argues how the research on the mathematics teacher becomes a practice that governs mathematics teacher's subjectivities through the enunciation of the desire subject, a productive, successful and effective teacher.

Keywords: The mathematics teacher, effects of power, quasi-Darwinism.

Introduction

Providing quality mathematics education has been a concern within the mathematics education community, research on education and international agencies. It is argued that the quality of education and the development of mathematical knowledge is essential for society and social development (Gellert, Hernández, & Chapman, 2013; OECD, 2010b). The idea is circulating that success in school mathematics is a prerequisite for personal and social success. Nowadays, it is considered that mathematics is a powerful mean to understand and control one's social and physical reality (OECD, 2010a), by being a tool and skill that helps people to undertake diverse tasks and problems of everyday life, and of their contexts (OECD, 2014b). However, according to OECD (2014a), modern societies valorize individuals not for what they know, but for what they can do with what they know, in other words, by their *mathematical literacy*:

Mathematical literacy is an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. (OECD, 2010b, p. 4)

Research in the field of mathematics education is seeking to modify reality – in the frame of social changes – through its findings, proposing rationalities, knowledge, and ways of improving education practices – for ensuring the quality of teaching and learning of mathematics. Furthermore, OECD (2014a) stated that “[h]igher educational achievement benefits both individuals and society, not only financially, but in the well-being with which it is also associated, such as better health outcomes and more civically engaged societies” (p. 104). In this fashion, the mathematics teachers become relevant, since they are considered as a central element in the establishment of quality education (Jong & Hodges, 2015; Luschei & Chudgar, 2015; OECD, 2005, 2014b). Several studies have argued on the relation between the quality of the mathematics teacher and the shaping of successful students (cf. Castro-Rodríguez, Pitta-Pantazi, Rico, & Gómez, 2016; da Ponte & Chapman, 2008; Hemmi & Ryve, 2015). Also, it is argued that the teacher is open to policy

influences, whereas factors regarding students and the classroom context are not open to the same policy influences, at least in the short run (OECD, 2005).

All the aforementioned, the circulating discourses around 'success' in mathematics, are positioning a way of thinking and understanding mathematics education through the configuration of valid methods of doing research and of arguing about the diverse issues involved in the teaching and learning of the mathematics. For example, "[a]ll research is built around a set of assumptions about the world and how it should be understood and studied" (Jablonka, Wagner, & Walshaw, 2013, p. 41). Thus, this paper problematizes mathematics education research and its effects of power on teachers' subjectivities and fabrication. A discourse analysis, inspired by Foucault's ideas, is deployed to unpack the naturalized truths and discursive formations about the effective and competitive mathematics teacher.

Movements to examine the mathematics teacher as a discourse formation

According to Pais and Valero (2012), mathematics education research produces languages and tools that shape what researchers see and say in the world of education and of mathematics education. Mathematics research as a field of inquiry is not an innocent or a neutral activity (Halai, Muzaffar, & Valero, 2016); it has been considered a "social institution which is inseparably linked to power" (Jurdak, Vithal, de Freitas, Gates, & Kolloosche, 2016, p. 10). In this fashion, mathematics education, and also its practices, is considered to be political because it operates within governmentality techniques. Hence, by building on these techniques of government, this paper aims to understand how mathematics education research fabricates the mathematics teacher's subjectivity through regulatory practices embedded within naturalized truths. In other words, it addresses how research sees and talks about the mathematics teacher, by establishing regimes of power/knowledge.

According to Foucault (1972), "[w]e shall call discourse a group of statements in so far as they belong to the same discursive formation" (p. 117). Hence, discourse as a group of statements, provides a particular language and knowledge, assembling regimes of truths. Circulating discourses describe rules and enunciations of a particular body of knowledge from specific spatiotemporal conditions (Arribas-Ayllon & Walkerdine, 2008). This paper deploys a "research on research" (Pais & Valero, 2012) strategy built on Foucault's discourse analysis. This analytical strategy helps to unpack naturalized truths within research, that seek to generate a productive and successful mathematics teacher, and, at the same time, to trace the power effects on the fabrication of mathematics teachers' subjectivities. So, by problematizing the discourses, it is possible to understand research as a practice that governs subjectivities through the enunciation of the desired subject.

First, repeated statements about the 'must be' of the mathematics teacher are identified. Second, these statements are analyzed to trace their knowledge/power relationships, and their continuities and discontinuities amongst each other. It does this by analyzing published studies about teaching and learning of mathematics. The empirical materials consist of research about mathematics teachers released within the last four years of three journals: *Journal of Mathematics Teacher Education*, *ZDM Mathematics Education*, and *Educational Studies in Mathematics*.

Finally, it problematizes how research and its discourses have effects of power in the fabrication of mathematics teachers' subjectivities. It does this by portraying how certain rationality is circulating

within research in mathematics education. As will be described, such rationality promotes a quasi-Darwinism, in which the survival of the fittest and the idea of evolution are the cornerstone of a network of practices and discourses.

The mathematics teacher research and the survival of the fittest

In navigating through the discourses that are circulating about the mathematics teacher, amongst the materials analyzed, it is possible to identify some enunciations that are continuously repeated. By following a Foucaultian chain of thought, these particular enunciations constitute statements about how mathematics teachers are supposed to act and be within their practices, their 'must be'. Such statements respond to concerns raised by research in the field of mathematics education. For example, who is taken as valid for arguing about mathematics teachers, what does a mathematics teacher ought to do, and how to seek for the improvement of the teaching and learning of school mathematics. From the analysis, some discourses about the 'must be' of the mathematics teacher are configured as truths. These truths are advertised as desired features that teachers should have if they want to perform successfully, namely: a high knowledge (Fauskanger, 2015), an updated repertoire of techniques (Subramaniam, 2014), and a personality consistent with their practices – personal aspects such as beliefs or attitudes (Jacobson & Izsák, 2015).

These discourses are naturalized under a competition and comparison system of reason. International standardized testing – PISA and TIMSS –, and its reports are examples of how competition and comparison become part of society, by shaping social discussions, decisions, efforts, and initiatives. At the same time, through those tests' outcomes, diverse countries could monitor themselves to improve the weakest areas, since "[a]ll countries are seeking to improve their schools, and to respond better to higher social and economic expectations" (OECD, 2005). In this fashion, a variety of studies, that seek to improve the teaching of mathematics (see Boston, 2013; Lewis, 2016; Pang, 2016), are aimed to identify how mathematics teachers could achieve a successful practice by analyzing their students' achievement on national and international tests. But, as discussed elsewhere, what is taken, by research, as a successful practice leads to a system in which teachers compete against others teachers, against what is considered as a desired teacher, and, also, against themselves (Montecino & Valero, 2016). So, research discourse is raising comparison as a mean for knowing the characteristics of competent and effective teacher – the fittest teacher –, effective practices or successful experiences. Within these discourses, it is possible to see statements such as:

By comparing and contrasting the practices of LS [Lesson Study] in mathematics in different countries, it will be possible to explicate the local theories of teaching and learning of mathematics, highlight educational values in each culture, and understand why and how these values support certain teacher development processes that are unique to the culture. (Huang & Shimizu, 2016, p. 394)

In the unpacking of naturalized truths of the analyzed materials, it is possible to see that some statements highlight mathematics teachers' deficits and flaws. These statements pay attention to what teachers need to improve in their lessons for increasing students' achievement (Spitzer, Phelps, Beyers, Johnson, & Sieminski, 2011). On one hand, by emphasizing that teachers need to achieve a higher expertise on school mathematical topics (e.g. Karakok, Soto-Johnson, & Dyben,

2015; Magiera, van den Kieboom, & Moyer, 2013). On the other hand, by focusing on the need for developing more effective teacher's practices (see Lee & Kim, 2016). This type of research acknowledges that mathematics teachers have a 'responsibility' for students' performances and, therefore, teachers ought to be highly trained. Alongside the statements about what needs to be improved, other statements exist that pay attention to what teachers lack, in other words, to skills that teachers are required to develop to reach what those studies perceive as 'successful professional development': on the one hand, studies regarding teachers' belief system (e.g. Conner, Edenfield, Gleason, & Ersoz, 2011; Cross Francis, 2015); on the other hand, studies regarding teachers' attitudes (e.g. Hannigan, Gill, & Leavy, 2013; Jong & Hodges, 2015).

According to some research, "[h]ow teachers perceive and adapt their roles will have great impact on overall classroom interactions, such as the teachers' questioning strategies or feedback patterns" (Lee & Kim, 2016, p. 366). This implies that teachers' decisions have an impact on students since it is believed that students' intellectual autonomy could be favored by teachers' practices (Goldsmith, Doerr, & Lewis, 2014). And so, the decisions made by the mathematics teacher have a high impact not only on students but also on their learning (Stockero & Zoest, 2013). This type of research shows that mathematics teachers should be constantly seeking to improve their professional development, practices, knowledge and skills not only for themselves but also for the sake of their students (Afamasaga-Fuata'i & Sooaemalagagi, 2014). Since professional development has been understood as a form of lifelong learning in which mathematics teachers are responsible for their own development and achievements, these types of statements, from a Foucaultian approach, are tracing the ways in which the mathematics teacher should become an effective and competitive teacher, through processes of self-regulation.

According to these studies, teachers should aim at improving, by themselves, diverse personal and technical aspects. Such aspects are supposed to encourage the development of a more effective and competent teacher, by recognizing their own deficits and flaws with the goal of overcoming them. This naturalized truth resonates not only within research but also amongst other discourses on education. For example, OECD (2012) states that effective teachers are a key to close achievement gaps between advantaged and disadvantaged students. And, therefore, the aim should be to (re)train and (re)shape teachers to become the desired effective teacher. In this regard, research is tracing a sort of 'evolutionary line' for mathematics teachers, in which at the end of the line rests the desired mathematic teacher. Teachers should evolve when they achieve the desired levels of knowledge and skills established by society, becoming the productive, successful and effective teacher. However, these desired levels are in constant movement, being redefined by new social interests, concerns, desires and demands as well as new mathematical knowledge that the modern citizen should have. This means that mathematics teachers have to govern themselves into a constant process of change, of (re)training and (re)shaping. As Deleuze (1992) asserts, currently nothing is considered to be finished; all is in a constant becoming.

The idea of the 'evolutionary line' helps to tell the narrative of the becoming of the mathematics teacher as the survival of the fittest, since research in the field highlights the features of the 'fittest subject'. This portrays that the survival of the fittest – the desired mathematics teacher – involves practices of self-regulation, but also of competition against other teachers, practices that could lead to the exclusion of certain teachers labeled as 'inferior subject', unproductive, unsuccessful, and

inefficient. For example, Lee and Kim (2016) have argued that mathematics teacher training programs “should include more specific investment in the effective use of classroom dialogue for learning” (p. 378), a ‘fittest subject’ should evolve in an effective classroom communicator whereas the ‘inferior subject’ will not evolve as a classroom communicator, and, will therefore be taken as ineffective. Consequently, the survival of the fittest governs the self and conducts mathematics teachers’ practices towards the desire to evolve, (re)shaping the research about mathematics teachers within a system of reason rooted in a quasi-Darwinism, since it traces the paths for teachers to increase their abilities to survive, compete and evolve.

Quasi-Darwinism of mathematics education research and its effects of power

The analysis deployed has pointed to the existence of statements on the desired mathematics teacher, a self-regulated and evolved subject. These statements have been (re)producing certain truths about who the effective teacher is. For example, mathematics teachers should perceive themselves as responsible for others – i.e., their students’ performances –, as promoters of social change – i.e., by closing achievement gaps –, and also, as responsible for themselves – i.e., tracing their professional development and learning the best possible way. These statements are building a quasi-Darwinian view of mathematics teachers; an ‘evolutionary line’ that is embedded within the above discourses and shapes the fabrication of the fittest subject.

The quasi-Darwinism (re)shapes mathematics teachers’ ways of being and acting at a particular time and place, through discourses that are produced and reproduced under certain *regimes of power/knowledge* (Foucault, 1982). The naturalized truths are constituted, on the one hand, within a particular regime of knowledge, which delineates who is the one to discuss about the mathematics teacher and how, and in what way the knowledge regarding the teacher should be generated. On the other hand, within a regime of power which defines what understanding is meaningful to be studied – what discourses are taken valid regarding certain issues or aspect of the mathematics teacher – and which practices, knowledge and techniques should be targeted. Therefore, a quasi-Darwinian view (re)produces what the mathematics teacher should be – the becoming – towards the development of the ‘human capital’ (OECD, 2001). Human capital voices the value that subjects have in correlation with their knowledge, skills, education and preparation for the future, which translates into personal, social and economic well-being. Alongside, a quasi-Darwinian view (re)shapes a discourse aimed at optimizing the becoming of the teacher. Moreover, the research on mathematics teachers seeks to minimize all aspects that could lead to an ‘inferior subject’. In order to be the fittest, teachers should engage in practices that turn them into accountable and measurable agents.

In this regard, it is possible to state that research in the field of mathematics education becomes a technology of the self (Foucault, 1997) that regulates mathematics teachers’ conducts towards the shaping of the desired mathematics teacher. By promoting ‘cultural thesis’ (Popkewitz, 2008) about the desired mathematics teacher, the analyzed research has effects of power on teachers subjectivities, meaning how mathematics teachers understand themselves and their becoming. Only the ‘fittest subject’ is the one able to develop the skills and knowledge that society demands and requires, is the only one who can evolve in a ‘superior subject’; subjects able to adapt themselves to the new social and professional demands. In other words, teachers are to evolve in subjects that

have the tools, skills, and knowledge to survive to all social changes and challenges; becoming a successful, effective, competent and fittest subject.

Thus, within the circulating discourses is configured a narrative in which if the mathematics teacher does not adapt or evolve, he/she is excluded or labeled as deficient. The teacher who survives through social changes and challenges is neither the knowledgeable teacher, nor the successful teacher, nor the most intelligent teacher; rather he/she is the most adaptable to change.

Acknowledgements

I would like to thank Melissa Andrade Melina and Lisa Björklund Boistrup for their comments to previous versions of this paper.

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Montecino, A. (2018). Outcome of the Market: The Outdated Mathematics Teacher. In M. Jurdak & R. Vithal (Eds.), *Sociopolitical Dimensions of Mathematics Education: From the Margin to Mainstream* (pp. 151-168). Cham: Springer International Publishing.

Outcome of the Market: The Outdated Mathematics Teacher

Alex Montecino

Abstract This chapter seeks, on the one hand, to illustrate the configuration of a mathematics teacher who is always considered to be outdated, and on the other hand, to discuss the circulation of a promise of salvation embodied in the discourses of permanent training. This chapter aims to contribute to the problematization of “what the mathematics teacher must be” and power effects in the fabrication of mathematics teachers’ subjectivities. A Foucault-inspired discourse analysis is deployed in order to unpack naturalized truths, as well as forces that govern and control teachers. It argues that current research on mathematics teacher frames teachers within a narrative that is characterized by a continuous enunciation of new repertoire of techniques, practices and knowledge that the teacher should have, to become successful. New social demands and interests are conducting teachers into investing more and more in themselves as the only way to improve and to not become outdated in order to stay in the system.

Keywords Mathematics teacher · Discourse analysis · Power effects
Permanent training

1 Introduction

Nowadays, everybody has something new to say about mathematics teachers and their roles, education, quality, responsibilities and performances, within which performances, seems to establish the idea that the mathematics teacher always has to improve. Studies about the mathematics teacher, for example, those produced by researchers of mathematics teachers and those that support various Organisation for Economic Co-operation and Development (OECD) reports, constantly (re)produce discourses which characterize the effective and successful teacher (see Jacob et al. 2017; OECD 2012). They circulate ideas of how mathematics teachers must be, the

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© Springer International Publishing AG 2018
M. Jurdak and R. Vithal (eds.), *Sociopolitical Dimensions of Mathematics Education*, ICME-13 Monographs, https://doi.org/10.1007/978-3-319-72610-6_9

151

desired practices, knowledge and outcomes that mathematics teachers should have, as well as what is needed to develop or improve such teachers. They provide a way of thinking and understanding the mathematics teacher, through the (re)production of a network of discourses that are constantly reconfigured in response to social interests, problems, changes and demands.

These studies respond to the social concerns of getting better outcomes and overcoming the problem of failure in school mathematics, through the articulation of new practices, methods or techniques, supported by scientific knowledge. The desired mathematics teacher is articulated through the idea that mathematics is important for the development of persons, society and economy. Nowadays, it is considered that higher education achievement improves opportunities in the labor market and earnings expectations, thus benefiting the individual and their social well-being (OECD 2014a). Likewise, UNESCO (2007) has acknowledged that “mathematics education is a key to increasing the post-school and citizenship opportunities of young people” (p. 6). It is therefore seen as vital to improve the quality of teaching and learning of mathematics, as well as the quality of the people responsible for teaching mathematical knowledge to new generations—mathematics teachers.

Gutiérrez (2013) asserted that research on the mathematics teacher seems to have the aim of developing and promoting successful mathematics learning experiences for students. Through this aim, research is set as a means to encourage the improvement of all aspects of the teacher that are considered deficient, producing statements that are established and acted upon as naturalized truths—a contingent effect of relations of force (Ribeiro 2011). The mathematics teacher is configured as a product and agent (Montecino and Valero 2017), in other words, an object of policy that is configured for consuming and promoting valuable knowledge for society: the mathematical knowledge. Montecino and Valero (2017) show how international agencies give evidence of how it is possible to intervene so that the teacher becomes the best version of such product and agent. Moreover, mathematics teacher research constitutes an idea of the desired teacher and what characterizes one, establishing as truth that mathematics teachers must have knowledge and master a repertoire of techniques for their actions and performance, as well as possess personal attributes in accordance with their practices, but teachers are in a social context and have deficits that present obstacles to their effectiveness (Montecino 2017). The competitiveness and effectiveness of the mathematics teacher are constituted as the main focus for promoting ways of understanding and thinking about the teacher (op. cit.). This reduces mathematics teachers to the effectiveness and competitiveness that they have in the educational system, with respect to some standards or desires. Mathematics teachers become professionals, governed and governing themselves by a neoliberal rationality, in which expert knowledge and capitalist logic of consumption influence the becoming of teachers and their productiveness, effectiveness and competitiveness (op. cit.).

The circulating discourses show, on the one hand, how the mathematics teacher has to face new challenges and requirements, through practices, repertoires of techniques and knowledge considered successful and valuable. For example,

society requires that students develop an engagement with mathematics. A study by Skilling et al. (2016) explores secondary mathematics teachers' perceptions of student engagement in mathematics, concluding that it is "important for teachers to assess their personal beliefs about student engagement and consider how their practices in mathematics classrooms may or may not be supportive of students' mathematical engagement and learning" (p. 564). That is, through the development of tools and knowledge in the form of their capacity to reflect on their beliefs and practices, the mathematics teacher will become effective. On the other hand, in their constant search for the effective and competent mathematics teacher, studies reveal how some practices, repertoires of techniques and knowledge become obsolete or less effective, circulating the idea that the mathematics teachers have to be in a permanent process of training and improvement. This process is constantly changing as a function of social interests, demands and ideas of what is desirable. It is established as feared or undesirable for teachers not to reach the expected outcomes or levels of achievement, as well as for them to fail to keep up with rapid social changes and novel demands.

Thus, this chapter seeks to show how a mathematics teacher is always configured to be outdated. It is problematizing the constituting of the mathematics teacher, which is framed in a production strategy based on what is desired and on market logic, as well as the promise of salvation that responds to the fear that mathematics teachers may become ineffective or incompetent. Hence, it will propose that consumerism has become configured as the only method that mathematics teachers have for improving and not becoming outdated. In other words, the success of mathematics teachers depends on their investment in and consumption of permanent training. The contention of the chapter is that the mathematics teacher has to consume more and more training to stay in the system, having the constant risk of becoming an inefficient, not useful and valueless teacher. It also contends that the mathematics teacher cannot just be understood as a subject that has the job of teaching mathematics; the mathematics teacher cannot be reduced to a specific set of knowledge and practices useful for teaching.

This chapter is positioned within the study of the cultural politics of mathematics education (Valero et al. 2015; Planas and Valero 2016). Bringing together Foucauldian (e.g., Walshaw 2016) and Deleuzian (e.g., de Freitas 2016) analytical strategies, these studies provide an understanding of the cultural and historical constitution of educational practices in mathematics in a multiplicity of interconnected sites, in order to cast light on how mathematics as part of the school curriculum are technologies of power/knowledge, which shape and govern Modern subjectivities and rationalities. In this chapter, this positioning is present in the theoretical landscape adopted, as well as in the analytical strategies deployed. Thus, 'the mathematics teacher' that is referred to here is not to a specific teacher, but rather a notion of mathematics teacher that circulates and is constituted within a discursive network; the mathematics teacher is here considered as a discursive construction fabricated within rationalities and truths that respond to specific spatiotemporal conditions. The chapter deploys a Foucault-inspired discourse analysis (Arribas-Ayllon and Walkerdine 2008; Jørgensen and Phillips 2002), with which a

reading of ways of governing the mathematics teacher is opened up, based on what is enunciated as desired and the articulation of a certain form of reasoning and arguing. It is navigating through discursive formations and their resonances to identify forces and different regimes of power/knowledge that determine what is considered true and false regarding the mathematics teacher. But, why is the focus put on the discourses? Through discourses are described rules, divisions and systems of knowledge (Arribas-Ayllon and Walkerdine 2008), in which the notion of the mathematics teacher is constituted and the teacher is drawn. Within discourses, what it means to be a mathematics teacher and what characterizes one, as well as the desired mathematics teacher, are traced.

The empirical materials on which the discourse analysis is deployed consist, on the one hand, of research about the mathematics teacher released within the last five years in scholarly journals (*Journal of Mathematics Teacher Education*, *Zentralblatt für Didaktik der Mathematik* and *Educational Studies in Mathematics*), and on the other hand, of reports published by the OECD, specifically reports focused on mathematics education and the mathematics teacher, as well as those focused on social welfare and development.

The chapter will follow three movements. Firstly, it discusses the spatiotemporal configuration in which the discourses are shaped, where the mathematics teacher is thought of as a self-regulated professional who always needs to improve. The notion of the '*society of control*' (Deleuze 1992) is used to understand the role of expert knowledge in governance mechanisms. Secondly, it examines the dominant discourses about mathematics teachers and shows the circulation of a promise of salvation based on the need or demand for permanent training. It outlines what characterizes the becoming of the mathematics teacher; a becoming that must undergo continuous change and redefinition with the aim of facing new demands and challenges. And thirdly, it problematizes the constituting and configuration of the outdated mathematics teacher, which embody capitalist and neoliberal rationality. Then, it is established that the success of the mathematics teacher depends on his/her investment in and consumption of permanent training, having a particular effect on the mathematics teacher's ways of acting and being, as well as controlling the teacher through the insatiable search for answering social demands and needs for improvement.

2 Society of Control and Discourses on the Mathematics Teacher

In order to understand how the discursive assemblage of social demands constitutes the mathematics teacher and configures a particular kind of teacher, a reading of the present is opened through the notion of the *society of control* (Deleuze 1992). Firstly, the society of control should be understood not as an overlap, but rather as a displacement of Foucault's *disciplinary societies*. Deleuze "seeks to supplement

Foucault's analysis of disciplinary power by defining new mechanisms of control which, it is suggested, have largely displaced the techniques of power described by Foucault" (Patton 2000, p. 26). Secondly, the society of control should be understood in relation to current capitalist society, in which the focus is not on a particular individual, but on a group of individuals, the mass. The societies characterized by confinement, disciplinary societies, in which the "individual never ceases passing from one closed environment to another, each having its own laws" (Deleuze 1992, p. 3), turn open, in order to enter the market, where the control "is short-term and of rapid rates of turnover, but also continuous and without limit, while discipline was of long duration, infinite and discontinuous" (Deleuze 1992, p. 6). There is an abstraction of all social and personal aspects, which become samples or data, where "the science of the state" or "statistics" (Foucault 1991 [1978]) are put into operation to shape governmentality techniques (Foucault 2010). For example, in international comparative studies, such as reports of the Programme for International Student Assessment (PISA), students involved become samples or data that are studied to formulate discourses as a function of their outcomes, such as, "[o]n average across OECD countries, boys outperform girls in mathematics by eight score points" (OECD 2016a, p. 196). The individual is lost; what is relevant is whether the mass, the particular student group or country involved, achieves what is considered necessary for the input or output of certain categorizations or achievement and development levels. The OECD (2016a) asserted that

[o]n average across OECD countries, only 2.3% of students attain Level 6 [score higher than 669 points in PISA]. More than one in ten students perform at this level in Singapore (13.1%) and Chinese Taipei (10.1%). In B-S-J-G (China), Hong Kong (China), Japan, Korea and Switzerland, between 5% and 10% of students attain proficiency Level 6. In 30 participating countries and economies, between 1% and 5% of students perform at this level, in 21 countries/economies, between 0.1% and 1% of students performs at Level 6, and in 12 other countries/economies, fewer than one in one thousand students (0.1%) performs at Level 6. (pp. 193–194)

On the basis of students' performance on standardized tests, diverse countries formulate new requirements for teachers and schools, enunciating what to do and how to do it, conducting the conduct of mass:

[M]ore and more countries are looking beyond their own borders for evidence of the most successful and efficient education policies and practices. [...] PISA allows governments and educators to identify effective policies that they can then adapt to their local contexts. (OECD 2016b, p. 3)

Currently, the teaching and learning of mathematics is a cornerstone of modernity, social progress and development, since mathematics provides the language of science and technology, as well as a rationality desired for subjects. It is possible to see that mathematical development is the foundation of much of the scientific and technological activity that distinguishes advanced from those less advanced. The value of mathematics is "a result of the formal place mathematics occupies within late capitalism" (Pais 2013, p. 20). In this fashion, it has been enunciated that school-level mathematics is relevant, since it "can enhance

“personal and social capability” by providing opportunities for initiative taking, decision making, communicating processes and findings” (OECD 2015, p. 99). The idea circulates that the proper acquisition of mathematics skills, especially numeracy, is needed for citizens to achieve their full potential and development, enabling them to excel and have better lives. Moreover, it is recognized that “mathematics education inserts children in the great Modern narrative of knowledge for problem solving [...], causing] children to see themselves as agents who can bring about change in the world and so contribute to the betterment and progress of society” (Valero and Knijnik 2015, p. 35). But, it is not enough for a person merely to have mathematical knowledge. Rather, he/she has to have the skill to put such knowledge into operation in diverse contexts, what is called *mathematical literacy* (see OECD 2014a).

Research focused on mathematics teachers has been developed from diverse frameworks and approaches. This kind of research has gained relevance in mathematics education:

As the field of mathematics education grows so too do the research methods used to study the field. In the special area of teacher education, the last decade has witnessed a substantial increase in attention. New perspectives and new methodologies have been constituted and new research techniques established. (Gellert et al. 2013, p. 327)

Literature reviewed by Goldsmith et al. (2013) shows that several lines of research have been developed in the professional learning of practicing teachers of mathematics. They identify several crosscutting themes in the literature, proposing that growth in one aspect of teachers’ knowledge and practice may promote growth in other areas. The studies analyzed were clustered into nine categories or areas: teachers’ identity, beliefs, and dispositions; teachers’ instructional practice; mathematical content of lessons; changes in classroom discourse; promoting students’ intellectual autonomy; teachers’ collaboration/community; teachers’ attention to student thinking; mathematics content knowledge; and curriculum and instructional tasks.

The research has become a mechanism of control. Through research, it is possible to know whether teachers have the quality levels required in their training and practices to ensure certain outcomes. Within research, the teacher’s ways of acting and being are directed on the basis of what is enunciated as the desired mathematics teacher and what characterizes this ideal teacher. Through this mechanism, the mathematics teacher is framed in the logic of competition and comparison. Teachers have to compete and be compared against each other, in order to show that they are competent and effective, that they are better than others, and that they have everything necessary for reducing the gap between themselves and the desired teacher. Competence and comparison are configured as important elements of the neoliberal agenda, which are promoted as a means for improvement. Competence and comparison are set as a way of governing the conduct of the mathematics teacher, as well as a way of life and of thinking, constituting truths and discourses regarding what is possible and desired. It is believed that competence and comparison contribute positively to increasing teachers’ competitiveness and

effectiveness, since through these they can know their strengths and weaknesses, as well as what they need to improve to become successful and to be regarded as quality teachers.

Nowadays, it is impossible to think about mathematics teachers without considering their social connections or implications. Mathematics teachers and their education have “links and connections to many other fields within and outside mathematics education” (da Ponte 2013, p. 489). Therefore, it has been recognized, within different levels of the social sphere and by different agents, that the teachers play “a unique role as experts who provide opportunities for students to engage in the practices of the mathematics community” (Bleiler et al. 2013, p. 105). Also, navigating through the discourses that circulate about the mathematics teacher, it is possible to see how this teacher is constituted in relation to social interests and demands. For example, a general demand drawn from different levels of social spheres is to improve people’s quality of life and well-being. This demand has put into operation dispositives and forces that seek to improve educational achievement, since it is believed that high educational achievement helps to improve the quality of life and the well-being of a person (OECD 2016a, b). Along with this, there is also the demand for an effective and competitive teacher, a highly qualified individual who possesses excellent teacher training and, thus, up-to-date professional knowledge and skills, to address challenges that arise in the search for ways to improve educational achievement. So, the mathematics teacher is constituted as a product of discursive assemblage of social demands and interests, in which the idea is set and circulated that better mathematical achievement will lead to the improvement of living conditions at individual and national levels.

Inside the circulating discourses are deployed a large number of arguments about the things that the teacher must improve to become a “good” teacher, in other words, an effective, competitive and successful teacher. The idea of a “good” teacher promotes, on the one hand, the setting of truths, rationalities, discourses and subjectivities; and on the other hand, defines the space for what is allowed and prohibited, by configuring a network of forces and enunciations to which the mathematics teacher is subjected. However, the circulating discourses are constantly reformulating what is considered a “good” teacher. Over recent decades, there have been great efforts to improve teaching and develop teachers (Huang and Shimizu 2016). Within discourses circulate a long list of qualities and capacities that the teacher needs to develop in order to fulfill different aspects that lead him/her to be recognized as an effective, competitive and successful teacher. There is an emphasis on communication, detecting students’ learning, knowledge, tools and skills that the teacher needs, (among others). For example:

Teachers need to be able to notice children’s means of communicating their reasoning in order to respond appropriately to enhance children’s reasoning and communication of their mathematical thinking. (Bragg et al. 2016, p. 524)

Teachers need specific knowledge and affect-motivational skills to diagnose students’ learning during class. (Hoth et al. 2016, p. 44)

The kind of education needed today requires teachers to be high-level knowledge workers who constantly advance their own professional knowledge as well as that of their profession. Teachers need to be agents of innovation not least because innovation is critically important for generating new sources of growth through improved efficiency and productivity. (OECD 2012, p. 36)

Teachers need to understand (1) the conceptual principles and the development of the ideas underlying a concept; (2) strategies, representations and misconceptions; (3) meaningful distinctions, definitions and multiple models; (4) coherent structure—recognizing that there is a pattern in the development of mathematical ideas as a concept becomes more complex; and (5) bridging standards—understanding that there might be gaps between standards and knowing what underlying concepts are in between to bridge the gaps between the standards. (Suh and Seshaiyer 2014, p. 209)

The enunciations of what the mathematics teacher needs or has to improve, continually expresses the double gestures (Popkewitz 2008b) of hope and fear. Society hopes that the mathematics teacher will become a competitive and effective teacher who embodies ways of thinking and acting, promoting a particular rationality. But, at the same time, it is enunciating the feared mathematics teacher, which society does not desire, a teacher that will hinder society in what it seeks to achieve. Within circulating discourses have constituted that the expert knowledge shapes a promise of salvation based on permanent training, in order that mathematics teachers do not become an undesired and valueless teacher—an outdated teacher. Moreover, within the expert knowledge, a notion of the teacher as a desired, self-regulated and productive teacher is constituted. Then, those teachers, whose subjectivities are adjusted with what is desired, will be saved, while those who do not achieve the desired adjustment, will be outside the system and will be excluded. Within double gestures, the becoming of the mathematics teacher is drawn, revealing the features of the successful mathematics teacher. The becoming of the mathematics teacher is characterized by constant changes, which are a function of the emergence of new social demands and requirements. Nowadays, nothing is finished; in other words, everything is in a state of permanent becoming, and the mathematics teacher is no exception. In the words of Deleuze (1992),

[i]n the disciplinary societies one was always starting again (from school to the barracks, from the barracks to the factory), while in the societies of control one is never finished with anything—the corporation, the educational system, the armed services being metastable states coexisting in one and the same modulation, like a universal system of deformation. (p. 5)

3 A Promise of Salvation

The circulating demand of better mathematics teachers, effective and competitive teachers who can overcome new social challenges and requirements and who are always adapting and improving, constitutes a network of discourses in which the becoming of mathematics teachers is shaped. The becoming of teachers is in

perpetual change and their quality has been constantly questioned. From different perspectives, theories and methodologies have enunciated that “teachers are key to increasing educational quality” (Luschei and Chudgar 2015, p. 3), as well as that mathematics teachers have diverse deficits, for example, in their knowledge, resources for teaching or outcomes, among others. Francis (2015) shows that a low sense of efficacy and perceived lack of preparation are two factors that impact how teachers teach and interact with their students. Hence, “teachers in classrooms are the main factor in bringing about improvement in students’ outcomes” (Callingham et al. 2015, p. 552). Within discursive formations circulate as truth the notion that the mathematics teacher needs to be in a constant state of improvement with regard to all his/her professional and personal aspects in order to become a successful, effective and competitive teacher. In this vein, it is enunciated that

teachers should gradually improve their practice over time by engaging in systematic analysis of the effects of instruction on student learning. (Spitzer et al. 2011, p. 68)

[It] highlights the importance of teachers and school and system leaders increasingly taking responsibility for improving the enactment of the sequence, and for drawing on the underlying principles in various aspects of their practice. (Cobb and Jackson 2015, p. 1029)

The present study showed that French teacher training in the concepts of attribute and measurement is insufficient and therefore must be expanded. First, it is necessary to improve future teachers’ mastery of these concepts, which means developing their attribute/measurement SCK [specialised content knowledge]. (Passelaigue and Munier 2015, pp. 333–334)

Future studies are needed to explore strategies to help teachers improve their pedagogical design capability and flexibility to handle emerging events in the classroom. (Cai et al. 2014, p. 279)

These statements articulate discourses about not only what teachers should improve or change but also about whom they should become, by illustrating the desired teacher that society needs or demands. Moreover, it is recognized that initial teacher education is insufficient to satisfy the new challenges and changes that society sets. There is the fear of failure, as well, that the mathematics teacher becomes outdated. Current social changes happen fast, promoting new demands and requirements that the mathematics teacher has to face. In this context, various aspects of the mathematics teacher run the risk of becoming inefficient, lacking in usefulness or value because they respond to a reality that has already changed. Societal demands draw a network of forces, which delineate and shape what the mathematics teacher must be and do. But, these demands are in movement, constantly (re)forming from new interests, events, needs and opportunities. Consequently, the mathematics teacher is continually redefined, including his/her practices, training and performances. Mathematics teachers must quickly adapt, changing and improving all aspects of themselves that are identified as necessary to be effective and competitive. The outdated aspect(s) of these teachers are constructed as a real problem for society, not just because such teachers could have difficulty in finding or keeping a job, but also because they could hamper the achievement of educational objectives or desired standards.

Studies and discourses about the mathematics teacher seek to put into operation arguments based on the empirical evidence produced by research, to promote the best way of redesigning and re-planning the teachers, their (re)training, practices, and work, delineating what it means to be a mathematics teacher, and what is considered urgent. They contend that “the investigation experience is very intense and has a high transformation and learning potential for the participants” (da Ponte et al. 2017, p. 292). This experience creates opportunities for developing new knowledge and skills, as well as promoting changes in the participants and in their identity, values, beliefs and ways of being, among other respects (op. cit.). Within circulating discourses, practices are constituted, as are repertoires of techniques and knowledge that are considered desirable and those that respond from evidence in the best possible way to social requirements, or that have been shown to be successful. The fabrication of the effective and competitive mathematics teacher, as well as his/her training, has been part of the agenda in recent years of mathematics education research and studies by international agencies, in which it is possible to see how “policy makers put pressure on teachers to perform according to their own pedagogical and curricular demands” (Lerman 2012, p. 188). Cochran-Smith and Villegas (2015) state that current research on the preparation of prospective teachers is based on two broad questions: the policy question, which involves issues of effectiveness as well as accountability; and the learning question, which involves the issue of how (prospective) teachers learn to teach in the 21st century. Regarding the quality of teachers, it is possible to see efforts at various levels, such as the reformulation of mathematics teacher training (see Lerman 2012) or the configuration of international policies to attract the best students to become teachers, retain the best teachers, increase teacher salaries, enhance working conditions for teachers and reward teachers that join schools with the greatest needs, with the aim of securing better-quality teachers (Luschei and Chudgar 2015; OECD 2005, 2012, 2014b). It is acknowledging the central role of teachers for the social and personal development, as well as for a better future.

The permanent training embodies the hope of an effective and competitive teacher, as well as the fears of those who are not seeking to improve their practices or not achieving the desired levels. The narratives of permanent training shape a promise of salvation regarding the failure or incompetence of mathematics teachers. The search for constant improvement entails enunciating the desired and undesired teacher, labeling one as good or bad teacher according to his/her outcomes, what they know to do, and their updated repertoire of techniques and knowledge. Permanent training is configured as a way of facing what are recognized as deficient aspects of the teacher, as well as a mechanism of continuous control of his/her academic and professional development, in order to ensure the quality of the teacher and encourage his/her standardization. Currently, it is impossible to think of the becoming or professional development of the mathematics teacher outside the process of permanent training. The permanent training is the action by which the mathematics teacher becomes “other” while continuing to strive to be “what is”, governing the mathematics teacher and his/her desires, fears, attitudes and ways of being, in order to produce the desired teacher:

The idea of permanent training is a way of maintaining control of a never-ending process for the teacher. The idea of permanent training is operating as part of a dispositive by setting diverse forms of control, discourses, and forces. Consequently, the mathematics teacher is condemned to be incomplete and to have constant deficits to overcome, since society and the market will always be setting new requirements, demands, and urgencies that the teacher must face. (Montecino and Valero 2017, p. 150)

Permanent training becomes the cornerstone for the realization of current effective and competitive teachers, shaping teachers' conduct by inculcating into them new ways of understanding their professional development, work, desires, and ways of acting and being. Socially, it seeks to fabricate a trained teacher who is able to improve through self-regulation and the pursuit of their interests. As Callingham et al. (2015) put it,

the teachers [...] had made a collective decision to focus on and improve their personal numeracy (or quantitative reasoning) in ways that would allow them to challenge their students appropriately. (p. 558)

Consequently, permanent training implies a promise to reshape teachers in such a way that they can address new social demands and changes. The narratives about the competitive and effective mathematics teacher have subjected the teacher to a process of permanent training, in which the shaping of teachers' subjectivities takes place. Permanent training ensures continuous control of academic and professional development and practices of the mathematics teacher. Also, the permanent training, which is a response to urgent needs, is required for providing "quality control" in teaching, and for favoring the standardization of teachers. Within these discourses there seems to be a need for the existence of teachers who fail or do not satisfy what is desired, and in this way, it is possible to keep open and active, a market for permanent training.

4 The Outdated Mathematics Teacher

The search for ways to improve the mathematics teacher has become the central aim of studies that have as their focus the mathematics teacher and his/her training, practices, knowledge, outcomes and other related subjects. According to circulating discourses, it seems that the teacher cannot achieve the quality levels that are desired, which constantly change. Expert knowledge sets and contributes to new regimes of truth about teachers, circulating the idea that all mathematics teachers have opportunities and possibilities for improving through permanent training. There is the constant risk that mathematics teachers become outdated if they are not updated and adjusted in a timely manner.

As a result of constant social changes, demands and interests, the competitiveness and effectiveness of the mathematics teacher are destined to have a limited useful life. For example, the repertoire of techniques that a teacher should currently have, or is currently demanded to have, will be different in the future. This change

is clear with the introduction of new technologies—e.g. calculators, computers, motion sensors—in the classroom since the 1980s. Teachers had to acquire new knowledge and techniques, in order to abandon the exclusive use of the blackboard and to integrate the new technologies into their practices.

Plenty of research has argued about what characterizes a good teacher and what teachers need to improve their practices, knowledge and achievements. For example, Ertle et al. (2016) enunciated that

teachers must ultimately learn to develop and conduct their own formative assessments. To do this, teachers need to understand their students' development of mathematical knowledge and thinking as well as the techniques (e.g., observation and interviewing) for supporting and assessing children's knowledge in a formative way. (p. 977)

Apparently, all teachers have the same opportunities, access and possibilities for improving. But, access to the permanent training is not for all. In the last years, there has been a turn from demands for obedience on the part of teachers towards demands that teachers be adaptable, flexible, versatile and entrepreneurial.

So teaching staff nowadays also need the competences to constantly innovate and adapt; this includes having critical, evidence-based attitudes, enabling them to respond to students' outcomes, new evidence from inside and outside the classroom, and professional dialogue, in order to adapt their own practices. (European Commission 2013, p. 7)

The constant enunciation of the new repertoire of techniques and knowledge that the mathematics teacher must have or develop to be considered a successful teacher becomes a form of governing, constituting notions about the mathematics teacher that organize their practices. These notions produce truths and discourses that determine what it is possible to say, do and be, and a form of governing that conducts the mathematics teacher into consumerism and accumulation. The teacher must invest in his/her professional development and consume new training offers to achieve the desired level of effectiveness and competitiveness, accumulating more and more teaching methods, knowledge, achievements, retraining and so on. It establishes that consumerism and accumulation of professional development are the only ways for improving and not becoming outdated, as well as a means for self-regulating and circulating in a society that functions according to the principles of the market. The role of the mathematics teacher seems to be reduced to knowing what to consume to satisfy social demands and needs, while at the same time, it seems that the teacher has developed the desire to possess newer and better techniques and knowledge, in order to be or to stay effective and competitive, since his/her training and preparation are not enough. "Yet despite widespread recognition that teachers need to learn more in order for students to learn more, there is little consensus about what it is that teachers should be learning" (Lewis et al. 2015, p. 448). Constant changes make it more complex to define or establish what it is that teachers should learn, have or develop. The only certainty is that teachers have to improve since they have or will be in deficit.

Rapid social changes are constantly increasing the gap between the actual mathematics teacher and the desired teacher. The mathematics teacher has to work at reducing this gap, by managing his/her training and updates, in other words, the

teacher needs to become a sort of enterprise for him/herself (Popkewitz 2008b), in order to pursue his/her better professional and academic development. Hence, in the words of Popkewitz (2008a), within a neoliberal society, the subject becomes an “individual who is continually pursuing knowledge and innovation in a never ending chase for the future” (op. cit. p. 310), which applies to the fabrication of the mathematics teacher nowadays. Teachers should perceive themselves as ‘agents’ (Foucault 2009) who are responsible for their own improvement and professional development. Teachers have to manage their professional development and investments, in order to improve and ensure their quality—teachers are responsible for themselves—and to keep up in the system. “[Q]uality is conflated with measurable progress within neoliberalism where national progress (economic growth and competitiveness) is matched with individual progress (personal growth and self-fulfilment)” (Llewellyn and Mendick 2011, p. 56). Circulating the idea that the more mathematics teachers are of quality, the greater the social progress. The individual ambition of the mathematics teacher (the searching for being the best or improving his/her quality) becomes a key element for neoliberalism.

The mathematics teacher is subjected to a market logic based on “individual capitalization” (Foucault 2010), indebtedness and economic investment, that seeks the normalization, standardization and control of all aspects of academic and professional development of the mathematics teacher. Standardization becomes a mechanism for segregation and differentiation since the standards are used as a way to measure the effectiveness and efficiency of the teacher. The mathematics teacher is configured through political, economic and social interests, which are focused on competitiveness, effectiveness and qualifications of the teacher with the aim of satisfying new challenges that the market sets. The market shapes the conditions for the mathematics teacher to become part of the idea of globalization, social progress and the competitive logic of current societies. The market determines what is valid, permitted and desired for the mathematics teacher. In other words, the market determines what must be the academic and professional development of the mathematics teacher, along with his/her training, practices, achievements and knowledge.

For neoliberalism and the society of control, the professional freedom of the mathematics teacher is a function of the market, and all areas of the mathematics teacher are cast in economic terms, namely in terms of costs and benefits. Mathematics teachers are led to act under their own individual interests, having the freedom of choosing what they want to consume with the aim of improving. Hence, the success of the mathematics teacher is a function of his/her capacity to invest and consume wisely. Moreover, the configuration and reshaping of the mathematics teacher are based on market principles; supply and demand promotes the mathematics teacher’s ways of being and acting, as well as their constant fear of becoming outdated, losing value and effectiveness.

The permanent training not only promotes continuous updating of mathematics teachers, but also inserts them into continuous practices of comparison and competition. These practices embody capitalist and consumerist ideas, whereby the mathematics teacher is denaturalized of his/her particularities, framing the

becoming of the mathematics teacher as an outdated teacher who is always in debt and lacking something. Teachers are governed and govern themselves in order to optimally satisfy the social demands conducting their ways of thinking and acting. Furthermore, because the mathematics teacher governs others, he/she plays a part in the furtherance of a capitalist rationality and of practices that nowadays are believed essential and natural for achieving personal and social success.

Governing people is not a way to force people to do what the governor wants; it is always a versatile equilibrium, with complementarity and conflicts between techniques which assure coercion and processes through which the self is constructed or modified by himself. (Foucault 1993, p. 204)

The expert knowledge puts into operation and (re)produces arguments for setting permanent training as the main means for improving and ensuring the quality of the teacher, despite all the evidence which shows that failure is unavoidable. Within research, there is a production of new forms of (re)training and methods for improving the mathematics teacher, each carrying the promise of being the Holy Grail for constituting the successful teacher, promoting in the teacher the desire for consuming it, in order to improve. Currently, mathematics teachers must engage in a constant training and improvement process. They should acquire not only the skills and characteristics of the desired teacher, but also certain ways of acting. In other words, teachers are subjected to practices that shape their conduct to achieve the qualifications needed and to improve, in order to be considered effective and competitive.

5 Conclusion

The pursuit of improving of each aspect of the teacher has, in large part, become the focus of studies regarding the mathematics teacher, formulating discourses around better practices, knowledge and repertoires of techniques that the teacher must have to achieve successful outcomes, to be considered competent and effective, and to not become outdated—discourses in which truths regarding what characterizes the desired mathematics teacher are (re)produced. The enunciation of new practices, knowledge and repertoires that the mathematics teacher must have or improve upon, become part of the technologies for governing the mathematics teacher. In the context of current societies of control, as Deleuze has pointed out, the rendering of subjects to the myriad of control mechanisms effectively turns people into the perfect subjects/objects of expansive, late capitalist markets. In other words, current technologies of conducting the conduct of individuals and societies bring us all, sometimes subtly and sometimes forcefully, into a world of value, consumption and marketization. Notions of the mathematics teacher—and connected subjectivities—are no exception.

Who would want to be educated by a bad or outdated teacher? Nobody. The desire for good mathematics teachers makes it almost impossible to problematize

and question the intrinsic goodness of the “necessity” for improving teachers. The “necessity” of permanent training feeds the illusion that there is a way for the mathematics teacher to become the desired teacher or at least to come close to it; that the teacher is not alone; that there are people working to help him/her; and that all the teacher’s deficits or problems can be fixed through research, constituting new regimes of the production of truth, in which truths are (re)produced from a scientific discourse. But permanent training does not only promote continuous updating of mathematics teachers, it also pushes them into continuous practices of comparison and competition. These practices frame the teacher’s possibilities within a capitalist and consumerist logic, since that comparison and competition leads the teacher to think that pursuing his/her personal interest, investing in him/herself through permanent training or any other aspect that can be capitalized will indeed result in added value and will lead to becoming the best possible modified version of a teacher. In the discourse of necessity in the market, the mathematics teacher surrenders to permanent training because he/she desires certain effects, seeking a personal and social benefit.

Nevertheless, the very same logic of societies of control operate that the desire for success often turns into failure. Despite the permanent training, the mathematics teacher is condemned to fail in acquiring new qualifications, and as a result he/she will be doomed to become outdated. The fabrication of the mathematics teacher seems to be framed in a narrative of *planned obsolescence*, since, on the one hand, the mathematics teacher is purposefully destined to become outdated, and on the other hand, the teacher is shaped to always desire the consumption of something new. Nowadays, most technologies and devices are designed with a short useful life, and the mathematics teacher is no exception. Planned obsolescence is the outcome of the decision that a product should no longer be functional or desirable after a predetermined period, determining its intrinsic durability (Cooper 2011). In other words, it is a purposeful strategy of built-in product design that reduces the product’s useful life, triggering in consumers the desire for a newer and better product of the same type. Planned obsolescence is one of the great inventions of recent electronic and digital technologies that operate with a high speed of change in products, which consumers perceive as necessary and highly desirable. The mathematics teacher is fabricated within a production strategy, the planned obsolescence, which seeks to stimulate economic activity (Cooper 2011).

In this way, the mathematics teacher becomes a part of a market logic, whereby issues such as professional qualification, effectiveness and levels of success (among others) take on particular relevance since they become control mechanisms, which can be quantifiable, for the identification of those who fulfill the quality requirements or standards. The mathematics teacher becomes a subject who never stops desiring more qualifications and training, since these are perceived as never being enough. The constant interplay between the discourse of salvation and the becoming of the outdated mathematics teacher has an effect of power on his/her ways of acting and being. The mathematics teacher is controlled by the insatiable search for responses to social demands, as well as the search for improvement. And this in itself becomes the very same condition for his/her being professional. It

seems as if the vicious circle between the desire for more qualifications and the fact that qualifications become obsolete creates a kind of illusion about what may be possible for teachers to in fact achieve. Learning to be a teacher whose competence, qualifications and professionalism are always insufficient raises the ethical question of which kinds of teachers are being formed. Is “a teacher in debt” (Montecino and Valero 2017, p. 150) an acceptable and desirable subject?

But at this point, one might ask, what happens with resistance? Are there no other possibilities to envision and conceive of mathematics teachers? According Foucault (1980), where there is power, there is always resistance, and resistance is never exterior to power. Moreover, discourse transmits and produces power, but it also undermines and exposes it (op. cit.). The mathematics teacher freely participates and navigates within mechanisms of power. However, the resistance cannot be total because when the mathematics teachers do not adapt, they become outdated. Thus, within the current configuration of a capitalist model, the mathematics teacher is shaped as product and agent, as well as a professional who must be effective and competitive. The mathematics teacher, as a professional, is required to know how to stay up to date. The resistance is made difficult, since if mathematics teachers do not improve and if they do not consume pursuing their interests, they will become valueless and outdated subjects. Moreover, the capitalist model resignifies all that is considered new, different and feared, including the resistance, in its own terms. Therefore, mathematics teachers are subjected to the flow of their society. Although possible, the cracks that may open opportunities for resistance, seem at the moment, quite difficult to see and from which to make profit.

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CHAPTER 6. FABRICATING THE MATHEMATICS TEACHER

Studies deployed have had as aim to problematize “the connections, encounters, supports, blockages, plays of forces, strategies and so on which at a given moment establish what subsequently counts as being self-evident, universal and necessary” (Foucault, 1991b, p. 76), regarding the mathematics teacher. The focus on the fabrication of the mathematics teacher has implicated to recognize how the discursive network plays a key role in the making of the mathematics teacher’s regimes of the self within a neoliberal rationality, in which the autonomy and self-government is operating in function of the maximization of his/her human capital for becoming a better teacher. Within discourses a desired mathematics teacher is fabricated by continually reshaping his/herself in function of what is socially demanded. The mathematics teacher must invest in his/herself in order to “act upon himself, to monitor, test, improve and transform himself” (Foucault, 1985, p. 28), seeking to become an effective and competitive subject to follow his/her personal interests and ambitions. The mathematics teacher is, in words of Cotoi (2011), “governed by and through their own interests” (p. 113).

Apparently, it seems to be necessary and desirable that the mathematics teacher has the tools and the knowledge to improve his/herself, until they do not require an “other”—he/she has to acknowledge their flaws by his/herself. The teacher must control each aspect of their development by investing in themselves, and thus, aspiring to become the desired mathematics teacher.

In pedagogical research, “the effective teacher” becomes one such determinate category about the kind of human to enact curriculum standards, to use learning research, and in the current econometric language of reform to provide “the value-added” qualities of instruction that will resolve what were until now the mysteries of children’s failure in school. The invention of “the effective teacher” is a desired kind of teacher. The research probes the effects of this theoretical abstraction through setting up ways of measuring and calculating as the effective teacher did exist to say something about its capabilities and qualities [...] The effective teacher is registered as a statistical difference in factors that adds “value” to efforts to improve achievement scores (Popkewitz, 2017, p. 249)

A narrative of salvation is constituted around the idea of the permanent training, which emerges as an answer to the constant social demands for a better mathematics teacher, who must constantly have more tools, knowledge, and techniques. Within permanent training, the mathematics teacher is thought in function of his/her competitiveness and effectiveness, those teachers that become different—better and *fittest*—have a value-added for society. The mathematics teacher and his/her becoming are conducted—in terms of Foucault—and controlled—in terms of Deleuze—through the illusion of improvement and achievement that the permanent training promotes. From this narrative, the mathematics teacher is redefined, on a binary logic, in function of his/her capacity of overcoming the new demands and all aspect that could be considered deficient. Thus, the research about the mathematics teacher rather than being seen as a means where the searching of truth about the teacher is encouraged; it must be seen as a way of regulation of discourse. Researching the mathematics teacher has sought to explain rationally and scientifically the desired teacher's ways of being and acting.

The papers have revealed how the (re)production of a discursive network has operated as a technology of government for the fabrication of the desired mathematics teacher, and shown how this network is framed in a rationality that promotes a scientific gaze of the mathematics teacher. Discourses (re)produced by studies about the mathematics teacher are not innocent explanations or characterizations of roles, failures, and what is desired of teachers; they are a way of producing a reality through knowledge. The idea of the social and individual progress has circumscribed the production of current discursive network, in which the mathematics teacher is fabricated. The conditions of (re)production of knowledge regarding the mathematics teacher are part of a complex network of discourses, knowledge/power relationships, and desires. In which the research about the mathematics teacher has operated as a dispositive. The mathematics teacher is constituted as a subject that acts on him/herself and on others, at the same time an object and subject of knowledge. The studies about the mathematics teacher are highlighting the gaps between the desired mathematics teacher and teachers. This is done in order to accentuate the necessity of change and improvement, promoting teachers' consumption and investment in new (re)training programs. In the market constituted around the permanent training, there is everything needed for teachers to be successful and become a good teacher, at least that is what it is said.

The myth of the good teacher

The circulating discourses are drawing an apologetic narrative about the desired teacher, constituting a myth regarding the good mathematics teacher. This desired teacher is not a real teacher neither a reachable teacher, nobody achieves to be one even for those who are considered “good teachers”. The constant changes that the idea of what is desired has, reduces the possibility for teachers to achieve and become the desired mathematics teacher. Furthermore, these “adjudgments” on what

is desired produce the conditions for shaping the in *debt* mathematics teacher. Teachers will always need something more in order to meet social demands and desires; they will always need to improve because they will never be good enough. They are always becoming-other. Despite mathematics teachers not becoming the desired teacher, there must be the illusion of becoming the desired mathematics teacher, at least partially or momentarily. The discursive network promotes a regime of truth in which the fabrication and enunciation of the desired mathematics teacher are *(d)effecting* (Andrade–Molina, 2017) mathematics teachers, namely, there is a double gesture in the fabrication of the mathematics teacher. Mathematics teachers are being effected, at the same time that they are being (d)effected by what is desired. In this double gesture the teacher learns how to play the game for remaining in the system without being a “good teacher”. The abstraction of the good mathematics teacher is not only a kind of teacher, but it is also cultural thesis (Popkewitz, 2008) about what is desired and what counts as successful.

The struggle for survival

The mathematics teacher becomes a subject centered on him/herself, an entrepreneur of him/herself, since he/she is responsible for his/her own self–develop, success, and self–preservation. The individual ambition and endeavor are constituted as cornerstones for achieving the desired, thinking and acting in concordance with his/her personal interest. Mathematics teacher go back to a primitive state of survival, in which they have to *evolve* for becoming the *fittest* through the investment in themselves and the increase of their human capital. Cotoi (2011) argues, within Foucault’s view, that the human capital has the role of expanding and putting in operation the neoliberal model of *homo oeconomicus*—the homo oeconomicus is an entrepreneur—an entrepreneur of himself (Foucault, 2010). The constant searching for better mathematics teachers has made possible to pathologize the teacher in terms of his/her deficiency. Within discourses, it seems that mathematics teachers need to show that they are the *fittest*. Competence has become the incentive for personal improvement.

The mathematics teacher as a consumer

In order to be successful, the mathematics teacher has to think and to act in accordance with his/her personal interest; looking always ahead. The teacher becomes a *subject (rational) of consumption* (Miller & Rose, 2008): someone who is being governed to responding with “energy, initiative, ambition, calculation and personal responsibility” (N. Rose, 1996, p. 154). Through continuous consumption, the teacher can stay in the system, having access to (new) tools and knowledge for competing and increasing his/her human capital. The mathematics teacher is constantly consuming with the hope of improving—being in a continuous process of redefining his/her competences (Cotoi, 2011). A market of mathematics teacher (re)training converts the teacher (re)training in a consumer object, an object desired

by who seeks to improve or to see in it a kind of salvation. Through the programs of the teacher (re)training, the levels of outdated of the mathematics teacher are managed so that no teacher to be totally outside.

From “I must” towards “I want” and “I need”

By navigating throughout the discursive network, it is possible to identify the constitution of power/knowledge relations and processes of subjectivation in which the mathematics teacher turns from the “I must” towards the “I want” and “I need”. In other words, this turns involve different mechanism of power/knowledge for conceiving and fabricating the mathematics teacher. Currently, the mathematics teacher wants and needs to be the best not because of someone says to the teacher “be the best”, rather because he/she is self-regulated and self-controlled for being the best, becoming an autonomous teacher, “who is able to scientifically, rationally and consciously direct his or her thinking and action” (Sitomaniemi-San, 2015, p. 80).

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SUMMARY

This Ph.D. dissertation aims at problematizing the discourses about the mathematics teacher through an intensive reading, which is accomplished through a Foucault-inspired discourse analysis and historicizing of the present. This implies a critical questioning of dominant discourses about the desired teacher, power/knowledge relationships, technologies of government, and taken-for-granted truths. The discourse analysis enables to rethink the fabrication of the mathematics teachers without the teacher. It enables new ways of conceiving, thinking, and understanding the mathematics teacher as entangled with historical and social conditions. Building on Foucauldian and Deleuzian toolboxes, this dissertation troubles how the mathematics teacher becomes a neoliberal subject, and how certain technologies of government are assembled to make particular kinds of teachers—the desired mathematics teacher. The mathematics teacher is understood as a discursive formation that is submerged in a constant becoming and evolving.